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ABSTRACT

This monograph presents 14 articles on the topics of the nature and extent of drug use by the workforce; drug use and job performance indicators; and drug free workplace program research. These articles are included: (1) Research on Drugs and the Workplace: Introduction and Summary (Steven Gust, Dennis Crouch, J. Michael Walsh); (2) Drug Use Patterns and Demographics of Employed Drug Users: Data from the 1988 NIDA Household Survey (Andrea Kopstein, Joseph Gfroerer); (3) Drugs in the Military Workplace: Results of the 1988 Worldwide Survey (Robert Bray, Mary Ellen Marsden, J. Rachal, Michael Peterson); (4) Patterns of Drug Use in a Large Metropolitan Workforce (Wayne Lehman, D. Dwayne Simpson); (5) Drug Use Trends in a Nuclear Power Facility: Data from a Random Screening Program (Carl Osborn, Jacque Sokolov); (6) Mandatory Post Accident Drug and Alcohol Testing for the Federal Railroad Administration (FRA) (David Moody, Dennis Crouch, David Andrenyak, Rachel Smith, Diana Wilkins, Ann Hoffman, Douglas Rollins); (7) Development of Repeated Acquisition Methodologies To Detect Drug-Induced Disruption in Human Learning (Warren Bickel, Stephen Higgins, John Hughes); (8) Residential Laboratory Research: A Multidimensional Evaluation of the Effects of Drugs on Behavior (Marian Fischman, Thomas Kelly, Richard Foltin); (9) Effects of Alcohol on Human Behavior: Implications for Workplace Performance (Thomas Kelly, Richard Foltin, Marian Fischman); (10) Impact of Moderate Alcohol Consumption on Business Decision Making (Sarah Jobs, Fred Fiedler, Chad Lewis); (11) Application of Human Laboratory Data for the Assessment of Performance in Workplace Settings: Practical and Theoretical Considerations (Stephen Heishman, Jack Henningfield); (12) 1988 Bureau of Labor Statistics' Survey of Employer Anti-Drug Programs (Howard Hayghe); (13) Reexamining the Role of Supervisor Training (Bradley Googins, Robert Schneider, Neil Colan); and (14) NIDA's Role in Applied Research (Robert DuPont, Jerome Jaffe, Herbert Kleber). (ABL)

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National Institute on Drug Abuse

RESEARCH

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Drugs in the Workplace:

Research and Evaluation Data

Volume II

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Drugs in the Workplace: Research and Evaluation Data Volume II

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CONTENTS

Introduction and Summary

Research on Drugs and the Workplace:
Introduction and Summary 3
Steven W. Gust, Dennis J. Crouch, and J. Michael Walsh

Nature and Extent of Drug Use by the Workforce

Drug Use Patterns and Demographics of Employed Drug Users:
Data from the 1988 NIDA Household Survey. 11
Andrea Kopstein and Joseph Gfroerer

Drugs in the Military Workplace: Results of the 1988
Worldwide Survey. 25
Robert M. Bray, Mary Ellen Marsden, J. Valley Rachal, and Michael R. Peterson

Patterns of Drug Use in a Large Metropolitan Workforce. 45
Wayne E.K. Lehman and D. Dwayne Simpson

Drug Use Trends in a Nuclear Power Facility:
Data from a Random Screening Program. 63
Carl E. Osborn and Jacque Sokolov

Mandatory Post Accident Drug and Alcohol Testing for
the Federal Railroad Administration (FRA). 79
David E. Moody, Dennis J. Crouch, David M. Andrenyak, Rachel P. Smith, Diana G. Wilkins, Ann M. Hoffman, and Douglas E. Rollins

Drug Use and Job Performance Indicators

Development of Repeated Acquisition Methodologies to
Detect Drug-Induced Disruption in Human Learning. 99
Warren K. Bickel, Stephen T. Higgins, and John R. Hughes

Residential Laboratory Research: A Multidimensional
Evaluation of the Effects of Drugs on Behavior. 113
Marian W. Fischman, Thomas H. Kelly, and Richard F. Foltin

Effects of Alcohol on Human Behavior: Implications for Workplace Performance. 129
Thomas H. Kelly, Richard W. Foltin, and Marian W. Fischman

Impact of Moderate Alcohol Consumption on Business Decision Making. 147
Sarah M. Jobs, Fred E. Fiedler, and Chad T. Lewis

Application of Human Laboratory Data for the Assessment of Performance in Workplace Settings: Practical and Theoretical Considerations. 167
Stephen J. Heishman and Jack E. Henningfield

Drug Free Workplace Program Research

1988 Bureau of Labor Statistics' Survey of Employer Anti-Drug Programs. 177
Howard V. Hayghe

Reexamining the Role of Supervisor Training. 209
Bradley Googins, Robert Schneider, and Neil Colan

Commentary

NIDA's Role in Applied Research. 225
Robert L. DuPont, Jerome H. Jaffe, and Herbert D. Kleber

List of NIDA Research Monographs 241

Introduction and Summary

Research on Drugs and the Workplace: Introduction and Summary

Steven W. Gust, Ph.D., Dennis J. Crouch, M.B.A., and
J. Michael Walsh, Ph.D.

This Monograph contains reports from studies presented at the "Drugs in the Workplace" conference sponsored by the Division of Applied Research, National Institute on Drug Abuse held in September, 1989. This meeting was, in many ways, an extension of two earlier conferences held in 1986 and 1988, and had as its goal the advancement and dissemination of scientific knowledge about the prevalence, impact, and treatment of workplace-related drug use.

Drug use and its impact on the workplace continues to be a serious but illusive problem. High visibility events such as the tragic alcohol-involved grounding of the Exxon Valdez stands as a notorious example of the impact on society at large and the potential long term economic and environmental consequences of a single such incident. This and other dramatic examples, such as the 1986 railroad accident in Chase, Maryland, are only the most visible instances of how drug and alcohol abuse can impact the lives and well-being of not only the users but of many others, and ultimately, the health of our society.

The public response to these tragic and preventable events has continued to fuel the campaign to reduce drug abuse in this country. The portion of this campaign with perhaps the greatest overall potential to reduce illicit drug use is to achieve workplaces free of the impact of drug use. Indeed, data from NIDA's National Household Survey on Drug Abuse, which is representative of Americans over 12 years of age who live in households, suggest that approximately 70% of illicit drug users are employed. The Federal government and a large and growing number of private sector businesses have responded by establishing programs focused on prevention of drug use and treatment of drug users. Program components include screening for drug use, providing for treatment and rehabilitation for those in need, and other prevention and education programs and policies.

The Division of Applied Research at NIDA has established a research program to investigate the myriad issues related to workplace-related drug use. For example, until recently there have been little data available on the efficacy of Employee Assistance Programs (EAPs) in specifically addressing drug problems (other than alcohol), or the utility of drug testing at the workplace. To better understand, define and effectively address drug use and related problems in the workforce, NIDA is supporting research on the extent of drug use by the workforce, the impact of drug abuse on productivity and performance, and the effectiveness, costs, and benefits of various workplace strategies to deter, detect, prevent and treat drug abuse. The companion volume to this monograph, *NIDA Research Monograph 91, Drugs in the Workplace: Research and Evaluation Data*, was the first attempt to gather results from a diverse group of studies by scientists with widely different backgrounds and interests, but sharing relevance to these questions. This volume is an attempt to continue that effort.

Nature and Extent of Drug Use by the Workforce

There remain relatively few national estimates of the prevalence and frequency of drug use by employed people, and solid estimates of use while actually on the job are nearly non-existent. In the first paper, Kopstein and Gfroerer of NIDA's Division of Epidemiology and Prevention Research report data from NIDA's 1988 National Household Survey on Drug Abuse (NHSDA). The NHSDA provides perhaps the best national estimates of overall patterns of drug use in workplace populations. Although the rates of use were higher in the unemployed, significant levels of use were reported in the full or part-time employed. An estimated 8.2% of all full-time employed individuals reported current use of an illicit drug, that is, use at least once in the month prior to the survey. Rates of use in some subgroups were much higher. In fact, nearly 1 in 4 (23.8%) of full-time employed young males, age 18-25 yrs admitted current use of illicit drugs. Among the full-time employed, current use among males overall was much higher than for females (9.8% to 5.8%). These data are important in helping to assess the extent of use in the Nation and, in focusing prevention efforts toward appropriate high-risk groups.

Bray and co-authors describe data from the recent worldwide survey of military personnel that show dramatic changes in the admitted recent use of drugs and alcohol in the armed services. In the data base of over 18,000 service men surveyed, drug use declined from over 36% in 1980 to less than 9% in 1988. Similarly, consumption of alcohol, in the 30 days prior to the survey, decreased from 27% to 8% during the 8 year period. Other encouraging trends from the survey were a decrease in reported productivity losses and a continued downward trend in serious consequences from drug

or alcohol use. Bray reports that, consistent with the Household Survey, drug and alcohol use was greater for young males.

Are there regional and local variations in drug use patterns? Are there good methods for assessing the extent of the problem at the local level? These questions have not yet been fully explored. In contrast to the prior papers, which give excellent estimates in large and geographically diverse populations, Lehman, et al., address the question of local or regional variations in drug use patterns among 5,800 metropolitan employees. Lehman studied workers in various job classifications in a large Southwestern city. Preliminary data from the study showed that 29% of the employees admitted to being intoxicated within one month of the survey and 17% stated that this resulted in a job-related problem, such as absenteeism. Self-reported use of marijuana or cocaine was less than in the Household Survey, at 22% and 6% respectively, in the employee's lifetime. Only 1% said that drug use resulted in a drug problem. Phase 2 of the study will include urinalysis test results from a sample of the employees. It will be important to examine the correlation between self-report measures and urinalysis test results for implications for the validity of various measures of drug use.

Drug use by employees or contractors at nuclear power generating facilities is an important public safety issue. Osborn and Sokolov present data on the "Two Strike, Random Model" drug testing program at the Southern California Edison Company. The program was instituted in November, 1988 with the specific aims of detecting and deterring drug use by employees and contractors. The trend which Osborn and Sokolov report toward decreased urinalysis positive tests is encouraging and demonstrates that urinalysis data can be used for prevalence estimation and program evaluation within a worksite. The program is the result of considerable experience and many iterations and, therefore, presents a time tested model for managers and program developers to explore in their operational needs. Because of the numerous rigorous programs which have been established in the nuclear power industry, it should be a prime candidate for large scale, cross site drug program evaluation projects.

The use of drug testing as a prevalence estimation technique may also have applications in studies of the relationships between drug use and accidents. Moody and his co-authors report results of the Federal Railroad Administration's (FRA) post accident drug testing program. Consistent with other surveys, Moody and his coworkers found that cannabinoids, followed by cocaine and then ethanol were the most commonly detected drugs. Accident investigations by the FRA showed that drug and/or ethanol impairment was contributatory in 1/3 of the accidents in which they were detected.

Drug Use and Job Performance Indicators

NIDA has long supported studies of the behavioral effects of drug administration which have relevance to the issue of impaired worker performance. These studies include primarily laboratory studies of the effects of acute doses of drugs on batteries of cognitive and psychomotor tasks. More recently, NIDA has supported epidemiological studies examining the relationships between drug use and other workplace relevant performance measures. Together these studies are beginning to provide a strong data base on the relationship between drugs and performance which may be used to guide and inform program and policy development.

The fundamental behavioral changes that result from drug use may be subtle and difficult to measure, but must be understood to design and implement useful and effective treatment programs. The worksite poses a dynamic environment requiring constant data processing and adjustment by the worker for optimum performance and productivity. This complexity has made the study of work performance difficult to study. However, lab studies are more appropriate than field studies to explore the fundamental behavioral effects of drugs. The research described in this section illustrates that controlled, rigorous research on complex behaviors related to work performance can be conducted.

A related research goal is to develop alternate methods to rapidly and reliably determine impairment of employees. It may be argued that current procedures to measure impairment due to drug use are inaccurate, cumbersome, or overly dependent upon subjective measures. The development of a reliable, inexpensive, and rapidly administered performance assessment battery to detect impairment will have significant potential for application in the worksite. Papers in this section present results of relevant research on new measures of impairment and explore the potential of such research for establishing performance assessment batteries.

In terms of actually measuring performance impairment, Bickel, et al., point out that urinalysis testing does not address the issues of impairment by drugs, fatigue or emotional problems. An easily administered, reliable, non-invasive technique to measure such impairment would be a significant improvement over current technologies. The authors argue that learning a new task may be a more sensitive indicator of impairment than performance of a well-learned task. They report studies of the effects of diazepam, alprazolam and triazolam on repeated acquisition tasks. This paradigm appears to possess several of the characteristics necessary for incorporation into a worksite application.

Fischman and co-authors have taken the view that the lab setting needs to emulate, as closely as possible, the real world environment where drugs are used. At John Hopkins University, a unique research facility has been established where drugs can be administered, under controlled conditions, but in settings which permit a large degree of normal day-to-day activities, including work. Illustrative data are reported for studies of marijuana and amphetamine administration. Caloric intake was increased 40% over controls when 5 marijuana cigarettes/day were self administered and, predictably, 70% less than controls when amphetamine was self administered. Subjects also increased their social interactions by 4-fold while in this marijuana smoking regime. Future studies will examine hangover effects and implications for use in the workplace.

The next two papers describe studies of the effects of alcohol on work-relevant behaviors. Kelly and his co-workers summarize much of the existing literature which attempted to measure alcohol's effects on human behavior. Several among the many contextual factors that may render a particular performance measure sensitive or insensitive to alcohol's effects are discussed. The profound effect that even moderate amounts of alcohol may have on social behavior is demonstrated in their studies.

A novel approach taken to assess alcohol's effects in a workplace setting is described by Jobs and colleagues. Their study assessed the effects of moderate amounts of alcohol on a laboratory simulation of business decision making. Their results stress the importance of examining the setting in which decision makers consume alcohol, indicating that environmental and social factors may interact with the pharmacologic effects of alcohol.

Heishman and Henningfield, of NIDA's Addiction Research Center, explore a number of issues relating to workplace testing for drug effects on performance. Questions and concepts typically addressed in human performance laboratory research are discussed from a "real world" workplace perspective. This chapter reiterates the importance of the numerous variables that may ultimately determine a drug's overall effect, and cautions against assessments which are made along limited dimensions.

Drug Free Workplace Program Research

Assessment of workplace programs covers a broad range of research topics. From surveys of the number, type, and characteristics of programs; to evaluations and controlled studies of the effectiveness, efficacy, cost, and benefits of various workplace models are important in our attempts to design and promote the best programs to minimize the impact of drug use in the workplace.

The Bureau of Labor Statistics, Department of Labor, conducted a survey of business establishments in 1988 which provides the best available information on the frequency and distribution of workplace drug testing programs, employee assistance programs (EAP), and/or formal policies on drug use. Howard Hayghe describes this nationwide study of a sample (N = 7,500) of non-agricultural establishments which shows, rather surprisingly, that fewer than half of workplaces had a policy regarding drug use. Hayghe also found that only 1 in 5 workers were employed in an establishment with a drug testing policy. Importantly, drug testing programs and EAPs were more common in larger organizations. Although 3.2% of all establishments had a drug testing program, and twice as many (6.5%) had an employee assistance program, the size of the company greatly influence the likelihood that either of these program components were in place. The rather startling implication of these figures is that the large majority of working Americans have not benefitted from any workplace drug intervention strategy.

Clearly, one key player in the management of "troubled" employees is the supervisor. It is therefore essential that the supervisor receive adequate training in order to achieve success in this role. Recognition of the importance of supervisor training has prompted EAPs to develop and conduct programs for this purpose. Laying the groundwork for an evaluation of the efficacy of various existing training program features, Bradley Googins and colleagues from Boston University present data on the nature and extent of supervisor training within EAPs. Phase two of their study will examine these programs with respect to a number of specific outcome measures.

Conclusions

The workplace is increasingly being regarded as the prime focus of drug abuse prevention and treatment activities. The importance of these activities is highlighted in the commentaries of Drs. DuPont, Jaffe, and Kleber in the final section of this monograph. Their comments serve to emphasize the opportunities which exist in both the Federal and private sectors to significantly impact the drug abuse problem. To take advantage of these opportunities we must establish effective programs, by balancing responsibilities and rights of employers and employees with the need to improve and protect the Nation's health and productivity. Adequate design and implementation of these activities, however, depends largely on the availability of an existing database of information which provides models that have achieved a high rate of success. These databases are beginning to take shape, and NIDA, realizing the importance of empirical data from well-designed evaluation efforts, has incorporated these types of applied research areas into its overall research mission. The papers contained in this volume hopefully contribute to that effort.

Nature and Extent of Drug Use by the Workforce

Drug Use Patterns and Demographics of Employed Drug Users: Data from the 1988 National Household Survey on Drug Abuse

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INTRODUCTION

Drugs and alcohol in the workplace can interfere with an employee's productivity and safe performance of job responsibilities. The use of drugs can also reduce an employee's dependability by increasing the number of days lost from work. Drug use by the members of the American workforce carries with it all the risks and problems associated with drug dependence. Studies on the human and economic cost of drug abuse indicate that the direct and indirect costs of drug abuse to business are substantial. These include decreased productivity, absenteeism, accidents at the workplace, additional health care, loss of trained personnel, theft, and the costs associated with prevention, treatment, and deterrence programs. The 1988 National Household Survey on Drug Abuse (NHSDA) indicates that there are 14.5 million current illicit drug users in the United States. Of these, 71 percent are between the ages of 18 and 34. This translates to 10.3 million people. This age group comprises a major part of our workforce. The 1989 White House National Drug Control Strategy states that the workplace is a focus for the prevention of drug abuse for adults. Research on drug use in the workplace cannot be limited to estimating the magnitude of the problem, but also must include the identification and examination of variables which may define and explain behavior patterns. To meet the goals of prevention, demand reduction and treatment, it is crucial to know the sociodemographic characteristics of employees who are at increased risk to abuse drugs or alcohol in order to direct resources within the workforce. This paper will provide prevalence estimates for drug use among the workforce and some of the sociodemographic factors associated with working drug users.

DESCRIPTION OF DATA SOURCE

The Household Survey was conducted in the fall of 1988 and included 8,814 respondents aged 12 and older. The sample was a probability based design that included an oversampling of Hispanics, blacks, and young people. Hispanics, blacks, and young people were oversampled in order to get more stable and reliable national estimates of drug use for these population groups. Data from the survey were weighted to result in estimates that are representative of the appropriate population subgroups. To provide as much anonymity as possible, the data were collected in a household interview which used self-administered answer sheets for drug use questions.

Estimates of the prevalence of drug abuse obtained from the Household Survey must be viewed as conservative because, even though great efforts are made to give the respondents anonymity, drug usage is a sensitive topic that can be underreported.

Current drug users are defined as those persons who have used an illicit drug in the month prior to interview. Consistent with published NHSDA data, drug use measures used in this paper include current (past month) illicit drug use, current marijuana use, past year cocaine use, weekly use of alcohol, and heavy use of alcohol. Any illicit drug use includes the use of marijuana, hashish, inhalants, hallucinogens, cocaine, or heroin, and the nonmedical use of stimulants, sedatives, tranquilizers, or analgesics. Past year use of cocaine is used because the sample sizes associated with past month use of cocaine were not sufficient for stratified analyses. Heavy drinking is defined by having 5 or more drinks on the same occasion 5 or more times in the past thirty days.

DRUG USE BY EMPLOYMENT STATUS

Although drug use prevalence is higher among unemployed than among employed persons, drug use among the employed, as seen in table 1, is substantial. Drug use prevalence clearly decreases with increasing age among full-time employed people. Nearly 19 percent of full-time employed 18 to 25 year olds and 13 percent of 26 to 34 year olds had used illicit drugs in the month prior to the 1988 household interview. The percentage of current illicit drug users fell to about 2 percent for the oldest employed persons (35 and older). Rate of illicit drug use among the unemployed population ranged from 28 percent for the 18 to 25 year olds to 5 percent for unemployed persons 35 year of age and older.

Nearly 17 percent of full-time employed 18 to 25 year olds reported the current use of marijuana and about 11 percent of 26 to 34 year olds were

current users of this drug. Again, for full-time employed persons 35 and older, the percentage of current marijuana users was about 1 percent.

Table 1. Prevalence of Substance Use by Selected Types of Use, Employment Status, and Age: 1988

Employment Status and Age Group	Past Month Use of Any Illicit[1]	Past Month Use of Marijuana	Past Year Use of Cocaine	Weekly Use of Alcohol	Heavy Use of Alcohol[2]
			Percent of Population		
Full-time Employed					
All ages 18+	**8.2%**	**6.8%**	**5.7%**	**39.9%**	**6.4%**
18-34 years	**15.2**	**13.4**	**10.8**	**42.5**	**8.8**
18-25 years	18.7	6.9	14.0	41.6	11.2
26-34 years	13.0	11.2	8.8	43.1	7.2
35+ years	2.4	6.8	5.7	39.9	6.4
Part-time Employed					
All ages 18+	**9.4**	**7.5**	**4.5**	**32.9**	**5.6**
18-34 years	**15.0**	**12.2**	**8.6**	**35.0**	**8.4**
18-25 years	16.7	14.2	10.8	40.6	11.2
26-34 years	13.0	9.8	5.9	28.1	5.1
35+ years	3.6	2.7	•	37.2	3.3
Unemployed					
All ages 18+	**18.2**	**14.8**	**9.5**	**32.9**	**7.9**
18-34 years	**26.7**	**22.8**	**14.1**	**38.0**	**10.0**
18-25 years	28.2	25.5	13.4	43.9	10.9
26-34 years	24.8	19.6	15.0	28.1	9.3
35+ years	26.7	22.8	14.1	38.0	10.0

[1]Includes use of marijuana, hashish, inhalants, hallucinogens, cocaine, heroin, and nonmedical use of stimulants, sedatives, tranquilizers, or analgesics.
[2]Heavy drinking is having 5 or more drinks on the same occasion 5 or more times in the past 30 days
•Low precision; no estimate reported
Source: National Institute on Drug Abuse, National Household Survey on Drug Abuse, 1988.

For cocaine prevalence, the data displayed is for past year use. Fourteen percent of full-time employed 18 to 25 year olds reported using cocaine in the past year, a higher prevalence than the 13.4 percent of unemployed 18 to 25 year olds that reported using cocaine in the past year. Almost 9 percent of full-time employed 26 to 34 year olds report using cocaine in the past year. For the unemployed, 26 to 34 year olds had a prevalence rate of 15 percent.

The prevalence patterns for alcohol are quite different than those observed for illicit drugs. Full-time employed 26 to 34 year olds were more likely than their unemployed counterparts to drink alcohol on a weekly basis (43 percent compared to 28 percent). Full-time employed 26 to 34 year olds were the age group with the highest prevalence of frequent drinking. Weekly use of alcohol prevalence does not decrease significantly with age. As seen in table 1, heavy drinking has prevalence patterns similar to those observed for illicit drugs. The age group most likely to drink heavily was the 18 to 25 year olds. Heavy drinking prevalence goes from a high of nearly 11 percent for 18 to 25 year olds to a low of 4 percent for persons 35 years of age and older. Unlike the weekly use of alcohol, heavy drinking declines with increasing age.

Sex Differentials for Drug Use by Employment Status

Overall, the 1988 Household Survey indicates that males are more likely than females to use illicit drugs. As seen in table 2, drug use among full-time employed males between the ages of 18 and 34 years of age is very high. Full-time employed males 18 to 25 years of age are almost twice as likely as full-time employed females of the same age to be current users of any illicit drug (24 percent of males compared to 13 percent of females). For 26 to 34 year old persons who are full-time employed, 15 percent of males reported current use of any illicit drug versus 9 percent of the females. Unemployed males and females also exhibited large differentials for drug usage.

The same large sex differentials are observed for the current use of marijuana where 22 percent of the 18 to 25 year old full-time employed males report past month use compared to 11 percent of the females. Full-time employed males in the 26 to 34 year old age category were twice as likely as their female counterparts to be current marijuana users (14 percent compared to 7 percent). Unemployed male 18 to 25 year olds were more than twice as likely as their female counterparts to be current marijuana users (39 percent versus 15 percent).

Very few females report heavy drinking. Among the part-time employed and unemployed categories, which included many female respondents, there were not enough women reporting heavy drinking to calculate reliable estimates.

DRUG USE AMONG FULL TIME EMPLOYED 18 TO 34 YEAR OLDS

The balance of this paper will only deal with the full-time employed population. Because of the low prevalence of drug use among persons 35 years of age and older, a national probability sample like the Household Survey does not allow for reliable statistical analysis of older employed drug

Table 2. Prevalence of Substance Use by Selected Type of Use, Employment Status, by Sex and Age: 1988

Employment Status and Age Group	Past Month Use of Any Illicit[1]		Past Month Use of Marijuana		Past Year Use of Cocaine		Heavy Use of Alcohol[2]	
	Male	Female	Male	Female	Male	Female	Male	Female
	Percent of Population							
Full-time Employed								
All ages 18+	**9.8%**	**5.8%**	**8.8%**	**3.9%**	**6.8%**	**4.1%**	**9.5%**	**1.7%**
18-34 years	**18.3**	**10.6**	**16.7**	**8.6**	**12.8**	**8.0**	**12.7**	**2.8**
18-25 years	23.8	12.7	22.1	10.6	16.8	10.7	17.8	3.3
26-34 years	15.4	8.9	13.7	7.1	10.5	6.0	10.0	2.5
35+ years	2.6	2.0	2.2	•	1.7	1.0	6.8	1.0
Part-time Employed								
All ages 18+	**13.2**	**6.8**	**12.6**	**4.5**	**8.1**	**2.9**	**15.2**	•
18-34 years	**15.7**	**14.6**	**14.6**	**10.7**	**11.1**	**7.0**	**17.6**	•
18-25 years	13.6	19.9	12.4	16.1	10.0	11.7	18.6	•
26-34 years	21.1	10.4	20.6	6.4	14.2	3.3	15.2	•
35+ years	9.8	1.5	9.8	•	•	•	12.3	•
Unemployed								
All ages 18+	**23.2**	**13.4**	**21.9**	**8.9**	**11.4**	**7.7**	**13.5**	•
18-34 years	**34.6**	**20.2**	**32.5**	**14.9**	**17.4**	**11.4**	**15.3**	•
18-25 years	41.1	18.6	39.2	15.3	16.1	11.3	19.8	•
26-34 year	27.7	22.2	25.4	14.5	18.8	11.5	10.6	•
35+ years	3.9	5.4	•	•	•	•	10.1	•

[1]Includes use of marijuana, hashish, inhalants, hallucinogens, cocaine, heroin, and nonmedical use of stimulants, sedatives, tranquilizers, or analgesics.
[2]Heavy drinking is having 5 or more drinks on the same occasion 5 or more times in the past 30 days
•Low precision; no estimate reported
Source: National Institute on Drug Abuse, National Household Survey on Drug Abuse, 1988.

users. Therefore, data displays for past month any illicit usage, current marijuana usage, past year cocaine usage, weekly alcohol use, and heavy drinking will be for full time employed persons between the ages of 18 and 34 years of age.

Sex Differentials and Substance Abuse for 18 to 34 Year Olds

As was discussed previously, males are more likely than females to use illicit drugs. The following pie charts further demonstrate the magnitude of the drug use problem for full-time employed persons 18 to 34 years of age. The pie charts in figure 1 indicate that nearly 18.3 percent of full-time employed males ages 18 to 34 are current users of any illicit drug as compared to 10.6 percent of females. For males, this percentage translates to approximately 4.7 million users nationwide and for females, 1.9 million users.

Figure 1.
Full-Time Employed Persons Ages 18 to 34 Years of Age Who Reported Past Month Use of Any Illicit Drug[1], by Sex: 1988

Males
Estimated Drug Users =
4.7 million

Females
Estimated Drug Users =
1.9 million

[1] Includes use of marijuana, hashish, inhalants, hallucinogens, cocaine, heroin, and nonmedical use of stimulants, sedatives tranquilizers, or analgesics.

Source: National Household Survey on Drug Abuse

For marijuana, figure 2 shows that 16.7 percent of full time employed males report current usage and 8.6 percent of full-time employed females report current use. These percentages mean that there are about 4.3 million employed male marijuana users and 1.5 million employed female users age 18 to 34 in our country.

Figure 2.

Full-Time Employed Persons Ages 18 to 34 Years of Age Who Reported Past Month Use of Marijuana, by Sex: 1988

Males
Estimated Marijuana users •
4.3 million

Females
Estimated Marijuana users •
1.5 million

Source: National Household Survey on Drug Abuse

As seen in figure 3, past year use of cocaine also shows a large prevalence differential between males and females. Employed males show a prevalence rate of 12.8 percent, which translates to almost 3.3 million employed users. Females had a prevalence rate of 8.0 percent which translates to 1.4 million past year working female cocaine users.

Figure 3.

Full-Time Employed Persons Ages 18 to 34 Years of Age Who Reported Using Cocaine Within the Past Year, by Sex: 1988

Males
Estimated Cocaine users •
3.3 million

Females
Estimated Cocaine users •
1.4 million

Source: National Household Survey on Drug Abuse

Even larger sex differentials were observed for heavy drinking. Full-time employed 18 to 34 year old males indicated a prevalence rate of 12.7 for heavy drinking compared to 2.8 percent of females, (figure 4).

Figure 4.

Full-Time Employed Persons Ages 18 to 34 Years of Age Who Reported Drinking Heavily in the Past Thirty Days, by Sex: 1988

Males
Estimated Cocaine users • 3.3 million

Females
Estimated Cocaine users • 0.5 million

Source: National Household Survey on Drug Abuse

Race/Ethnicity and Substance Abuse for 18 to 34 Year Olds

For all three race/ethnicities, as shown in table 3, males have almost double the drug use prevalence rates of females. Employed white males have higher rates of any illicit usage in the past month than their black and Hispanic counterparts. For males in all three race/ethnicities, the prevalence of past year cocaine use was similar, ranging between 10 and 11 percent. Employed black males have the lowest prevalence rates for past year use of cocaine and the current use of any illicit drug. Hispanic females have the lowest prevalence rate for all three drug behaviors. White employed males and females generally had the highest substance use prevalence rates. As seen with illicit drugs, working males of all three race/ethnicities were more likely to be drinking heavily than their female counterparts. White females were more likely to be heavy drinkers than black or Hispanic women. For males, blacks were less likely than whites or Hispanics to be heavy drinkers.

Personal Income and Substance Abuse for 18 to 34 Year Olds

Evaluation of the relationship between personal income and substance abuse revealed some very interesting prevalence patterns. For full-time employed males, a dramatic relationship is displayed in table 3 between income and prevalence rates for any illicit use and current marijuana use. Prevalence rates clearly increase with decreasing income. For any illicit drug use, prevalence goes from about 27 percent for the lowest income group to almost 11 percent for the highest income category. Current marijuana use ranges from about 26 percent for those with incomes less than $12,000 per year to 10.0 percent for personal incomes of $30,000 or greater. A regression analysis which included controls for age and population density did show a statistically significant correlation between male usage of marijuana and income. For male past year cocaine use, the prevalence rates did not

Table 3. Prevalence of Substance Use Among Full-time Employed Persons Ages 18-34 by Selected Type of Substance, Sex, Personal Income, and Race/Ethnicity: 1988

Employment Status and Age Group	Past Month Use of Any Illicit[1]		Past Month Use of Marijuana		Past Year Use of Cocaine		Heavy Use of Alcohol[2]	
	Male	Female	Male	Female	Male	Female	Male	Female
	Percent of Full-time Employed							
Annual Income								
Less than $12,000	26.8%	10.2%	25.5%	9.3%	17.8%	6.4%	18.5%	*%
$12,000 to $19,000	19.4	12.7	18.9	10.5	10.8	10.9	10.5	5.6
$20,000 to $29,900	17.8	6.4	14.0	5.6	12.4	5.3	12.8	*
$30,000 or over	10.5	14.4	9.7	9.3	10.9	12.2	9.6	*
Race								
White	19.1	10.7	17.5	8.9	13.0	8.8	13.4	2.8
Black	15.6	9.7	14.0	7.6	11.8	*	9.9	*
Hispanic	16.0	7.1	14.6	*	11.8	*	10.2	*

[1]Includes use of marijuana, hashish, inhalants, hallucinogens, cocaine, heroin, and nonmedical use of stimulants, sedatives, tranquilizers, or analgesics.
[2]Heavy drinking is having 5 or more drinks on the same occasion 5 or more times in the past 30 days
*Low precision, no estimate reported
Source: National Institute on Drug Abuse, National Household Survey on Drug Abuse, 1988.

exhibit a linear relationship and income was not significantly correlated. For employed females, past month use of any illicit drug ranges from about 6 percent for personal incomes between $20,000 and $29,999 to over 14 percent for the highest income group. Past month use of marijuana ranges from about 6 percent for persons earning $20,000 to $29,999 to over 9 percent for those with the highest and lowest incomes. Past year cocaine use generally increased with increasing income. A regression analysis showed that income did not predict current marijuana use for employed females. However, income was correlated with past year cocaine use, with higher income related to higher prevalence.

The analysis of heavy use of alcohol by sex and income gave similar patterns to those seen for drug usage. For males, the lowest income group had the highest prevalence of heavy drinking (18.5 percent). The males with the highest personal incomes had the lowest prevalence of heavy drinking with a prevalence rate of just over 12 percent. For females, the only income category reporting substantial numbers of heavy drinkers was the $12,000 to $19,999 category.

As seen in table 4, the prevalence patterns observed for weekly use of alcohol by income were completely different than those observed for illicit drug usage and heavy drinking. Overall, between 40 and 50 percent of full time employed males 18 to 34 years of age drink on a weekly basis. The

Table 4. Prevalence of Weekly Alcohol Substance Use Among Full-time Employed Persons Ages 18-34 by Sex, Personal Income, and Race/Ethnicity: 1988

Personal Income and Race/Ethnicity	Weekly Use of Alcohol	
	Males	Females
Annual Income		
Less than $12,000	39.5%	14.3%
$12,000 to $19,999	38.9	18.2
$20,000 to $29,999	36.2	19.4
$30,000 or over	48.6	23.6
Race		
White	41.4	18.6
Black	40.8	14.8
Hispanic	33.3	8.7

Source: National Institute on Drug Abuse, National Household Survey on Drug Abuse, 1988.

males with the highest personal incomes did have somewhat higher prevalence rates for the weekly use of alcohol. Females with the highest personal incomes were also more likely than their lower income counterparts to drink on a weekly basis. With regard to race/ethnicity, Hispanic males were less likely than black or white men to use alcohol on a weekly basis. White females were more likely than black or Hispanic women to drink weekly.

Substance Use in Specific Industries for 18 to 34 Year Olds

The data in table 5 show the drug prevalence rates for full-time workers in specific industries. There are many industries and types of jobs in which employees have an increased risk for using illegal drugs. Also, accidents in

Table 5. Prevalence of Substance Use Among of Full-time Employed Persons Ages 18-34 by Selected Industries, Selected Type of Substance and Sex: 1988

	Past Month Use of Any Illicit[1] 1988		Past Month Use of Marijuana 1988		Past Year Use of Cocaine 1988		Heavy Use of Alcohol[2] 1988	
	Male	Female	Male	Female	Male	Female	Male	Female
	Percent of Full-time Employed							
Construction	28.1%	•%	26.2%	•%	19.9%	•%	20.9%	•
Manufacturing	14.8	12.9	13.4	11.7	11.8	6.0	11.1	•
Transportation	18.4	•	17.3	•	13.3	•	9.5	•
Wholesale Trade	20.6	•	20.6	•	10.6	•	7.7	•
Retail Trade	13.0	13.4	10.8	9.6	9.8	13.1	16.0	•
Finance	25.3	•	25.3	•	21.7	•	7.7	•
Repair Services	22.7	•	19.2	•	16.0	•	16.0	•
Professional	21.6	11.3	17.3	8.6	9.2	8.4	11.4	•

[1]Includes use of marijuana, hashish, inhalants, hallucinogens, cocaine, heroin, and nonmedical use of stimulants, sedatives, tranquilizers, or analgesics.
[2]Heavy drinking includes people who have had 5 or more drinks on the same occasion on 5 or more days in the past 30 days.
•Low precision; no estimate reported
Source: National Institute on Drug Abuse, National Household Survey on Drug Abuse, 1988.

certain industries, such as transportation, increase the likelihood of injuries to others. Operators of commercial vehicles such as truck drivers, airline

pilots, bus drivers, and train operators have responsibilities which involve the safety of others. Truck drivers are particularly at risk for using illicit drugs because almost all of them are paid by the mile or by the load. This creates an economic incentive to fight fatigue, loneliness, or boredom and keep on driving. A 1988 Regular Common Carrier Conference (RCCC) Safety Survey found that marijuana, "speed", and cocaine were the drugs used most frequently by truckers. The 1985 Fatal Accident Reporting System (the National Highway Traffic Safety Administration) showed that about 4,500 people died in crashes involving tractor-trailer trucks. Not surprisingly, only 17 percent of the deaths were to the truck drivers. Truck drivers are only one example of a high risk occupational group.

Data from the 1988 NHSDA are displayed in table 5. Females generally exhibit low prevalence rates for drug use and heavy drinking. As was discussed previously, events which occur infrequently cannot be reliably estimated by general household surveys. Therefore, for many of the industries displayed in table 5, there were not reliable estimates available for females. However, those women working in manufacturing and retail trade displayed high prevalence rates. For past year cocaine usage, females in the retail trade industry had an even higher prevalence rate than males in the same industry. The largest sex differentials for the three drug behaviors were observed for professionals. Professional males were more likely than their female counterparts to be current users of marijuana or other illicit drugs. For past year cocaine use, 8 percent of females reported this drug behavior compared to 13 percent of professional males. To further evaluate these large differentials, the age distributions for female and male professionals were compared. For 18 to 34 year old professionals, the average age for both male and female workers was about 28. Therefore, the age distribution was not confounding the observed differences in drug prevalence.

Of the eight industries displayed for males in table 5, the prevalence rates for any illicit drug use ranged between 13.0 percent for those working in retail trade to 28 percent for those working in the construction industry. The industries which had past month any illicit drug use prevalence rates of over 20 percent for male employees are construction, wholesale trade, finance, repair services, and professionals. The industries with lower prevalence rates for any illicit drug use were manufacturing, transportation, and retail trade. Current use of marijuana was most prevalent among employed males in construction, wholesale trade, and finance. Past year use of cocaine was more likely for men in construction or finance, with 20 and 22 percent reporting cocaine usage, and repair services with 16 percent. Heavy drinking was most likely for men in the construction industry, with a prevalence rate of 21 percent.

SUMMARY

This paper has identified some characteristics of full-time working populations who are at higher risk to be substance abusers. In summary, employed people who use drugs are generally between the ages of 18 and 34. Heavy drinkers fall mainly between 18 and 25 years of age. Males are much more likely than females to use marijuana, cocaine, or other illicit drugs and alcohol on a frequent basis. For males, past month use of any illicit drugs and marijuana was higher among those with the lowest personal incomes. For females, past year use of cocaine was higher among those with the highest personal incomes. Females and males with high personal incomes were also more likely than their low income counterparts to use alcohol on a weekly basis. Industries with high percentages of male substance abusers were: construction, wholesale trade, finance, repair services and professionals. Industries with substantial numbers of female drug abusers were manufacturing, retail trade and professionals.

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Drug and Alcohol Use in the Military Workplace: Findings from the 1988 Worldwide Survey

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INTRODUCTION

The military is the workplace for 2.1 million active duty military personnel stationed across the world. As a workplace, the military is similar to many places of employment in the civilian sector. The military screens prospective workers, sets policies regarding appropriate work-related behaviors and sanctions for their infringement, and offers various incentives to encourage high-level performance. However, the military is a distinctive workplace in many other respects. For members of the armed forces and their families, the military is somewhat akin to a total community. Many military personnel not only work on base, but they also live on base and raise families there. Further, they are responsible for preserving and defending the Nation and, consequently, are subject to additional restrictions on their personal lives.

Drug and alcohol abuse for both civilian and military employees may result in productivity loss, absenteeism and tardiness, illness and injury, legal incidents, and problems in family life (Gust and Walsh, 1989). It is estimated, for instance, that drug-abusing employees are late three times as often as nonabusing employees, request early dismissal or time off work over twice as often, have over twice as many absences of 8 days or more, use three times the normal level of sick benefits, are five times more likely to file a worker's compensation claim, and are involved in accidents almost four times more often (Backer, 1987). Drugs and alcohol impair performance by increasing reaction times and decreasing visual sensitivity (Linnoila, 1978). These are serious problems for business and industry, and their impact on the military may be even greater because they may greatly diminish military readiness.

Military policy states that "alcohol and drug abuse is incompatible with the maintenance of high standards of performance, military discipline, and readiness." The military, therefore, seeks to prevent the misuse of alcohol and other drugs, eliminate the illegal use of alcohol and drugs, and rehabilitate those who need assistance. Programs are set forth to monitor the extent of drug and alcohol abuse among military personnel, detect and deter abuse, and provide treatment, education, and training (DoD, 1980).

The relationship between drug and alcohol abuse and the military workplace is reciprocal. On the one hand, drug and alcohol abuse can negatively affect the work performance of military personnel. Indeed, marijuana was implicated in the crash of an airplane aboard the aircraft carrier *Nimitz* in 1981 (Finegan, 1982). On the other hand, the military as a workplace may create conditions that affect drug and alcohol abuse. Alcohol or drugs, for instance, may be one means of coping with job-related stress. Military conditions such as being away from home and family, being isolated, or being exposed to high-risk situations may also result in greater use of alcohol and drugs (Polich, 1979; Holcomb, 1981/82). Military policies and programs may, however, discourage alcohol and drug abuse. Thus, the relationship between drug and alcohol abuse and the military workplace is complex and reciprocal. Drug and alcohol abuse may have negative effects on work performance and on the lives of military personnel, and military life and military policies may either encourage or discourage drug and alcohol abuse.

This paper examines some of these reciprocal effects between drug and alcohol abuse in the military workplace:

- the extent of drug and alcohol use among military personnel,
- negative consequences of drug and alcohol use among military personnel,
- the effects of drug and alcohol abuse on work performance, and
- the effects of the military workplace on drug and alcohol abuse.

This examination will consider some of the distinctive conditions of the military as a workplace and military policies that seek to limit drug and alcohol abuse.

DATA AND METHODS

Data are drawn primarily from the 1988 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel (Bray et al., 1988). The 1988 Worldwide Survey was sponsored by the Department of Defense

(DoD) and conducted by Research Triangle Institute of Research Triangle Park, NC. The 1988 Worldwide Survey is the fourth in a series of surveys that aims to examine the nature, causes, and consequences of substance use among military personnel and the impact of current and future policies and programs designed to limit substance abuse. Additional information is provided from earlier Worldwide Surveys conducted in 1980 (Burt et al., 1980), 1982 (Bray et al., 1983), and 1985 (Bray et al., 1986; Bray, Marsden, Guess, and Herbold, 1989).

Sampling and Data Collection

The eligible population for the 1988 Worldwide Survey consisted of all United States active duty military personnel stationed across the world except recruits, Service academy students, persons absent without leave, and persons who had a permanent change of station at the time of data collection. A probability sample was selected for the survey using a deeply stratified, two-stage, two-phase design. The first phase involved the selection of the first- and second-stage sampling units, and the second phase involved the selection of the nonresponse subsample. First-stage sampling units were major military installations stratified by military Service (Army, Navy, Marine Corps, Air Force) and world region (Americas, North Pacific, Other Pacific, Europe), and second-stage sampling units were individuals located at selected installations stratified by military pay grade.

The response rate for eligibles was 81%. Of the 18,673 completed questionnaires, 90% were obtained in group administrations of the survey at military installations; the remainder were obtained by mailing questionnaires to a subsample of nonrespondents from the group administrations. Details of survey methodology are described in Bray et al. (1988).

Sociodemographic Characteristics of Military Personnel

Table 1 presents the distribution of sociodemographic characteristics of eligible military personnel included in the 1988 Worldwide Survey. As shown, the military population is largely male, white, and likely to be married. Almost all population members have at least a high school education. The majority of active duty military personnel are ages 30 and younger, and three-quarters of them are stationed in the Americas region.

Measurement Approach

The study uses several measures of reported drug and alcohol use. Drug use is measured in terms of use of any drugs during the past 12 months and the past 30 months including marijuana/hashish, inhalants, hallucinogens, cocaine, heroin, and nonmedical use of prescription psychotherapeutic drugs.

Prescription psychotherapeutic drugs include stimulants, sedatives, tranquilizers, and analgesics used without a doctor's prescription for purposes other than intended. The measure of drug use, thus, includes illicit drugs as well as licit drugs used for nonmedical purposes.

Table 1. Sociodemographic Characteristics of Military Personnel

Characteristic	Percentage	Characteristic	Percentage
Sex		**Education**	
Male	88.8	Less Than High School	0.8
Female	11.2	High School Grad/GED	42.1
		Some College	37.7
		College Degree or Beyond	19.4
Race/Ethnicity			
White	69.4		
Black	18.5	**Age**	
Hispanic	8.0	17-20	13.8
Other	4.1	21-25	30.4
		26-30	22.2
Marital Status		31-35	14.9
Not Married	39.5	36 or Older	18.8
Married	60.5		
		Pay Grade	
Region[a]		E1-E3	21.0
Americas	74.5	E4-E6	51.9
North Pacific	5.1	E7-E9	10.4
Other Pacific	4.4	W1-W4	1.0
Europe	16.0	O1-O3	9.6
		O4-O10	6.1

Note: Entries are column precentages. Estimates are based on responses from 18,673 military personnel.

[a]Americas includes continental United States (CONUS), Alaska, Canada, Greenland, Iceland, Antigua, Bermuda, Cuba, Diego Garcia, Panama, and Puerto Rico. North Pacific includes Republic of Korea, mainland Japan, and Okinawa. Other Pacific includes Australia, Canton Enderbury, Gilbert Ellice, Guam, Hawaii, Johnston Atoll, Midway, Pacific Trust, Philippines, and Wake. Europe includes Belgium, Egypt, Greece, Italy, Netherlands, North Africa, Portugal, Saudi Arabia, Spain, Sicily, Turkey, United Kingdom, and Germany (formerly FRG).

Source: 1988 Worldwide Survey.

The prevalence of any drinking or heavy drinking during the past 30 days are the alcohol use measures. Any drinking refers to consumption of one or more drinks of beer, wine, or liquor during the past 30 days, while heavy drinking refers to consumption of five or more drinks per typical drinking

occasion at least once a week. The heavy drinking definition is based on a drinking-level classification scheme adapted from Mulford and Miller (1960).

The negative effects of alcohol and drug use experienced by military personnel are examined using measures of reported serious consequences, productivity loss, and dependence. These measures are based on occurrences attributed by the military member to alcohol or drug use in the past 12 months and include:

- **Serious Consequences**--UCMJ (Uniform Code of Military Justice) punishment, loss of three or more workdays, kept from duty 1 week or more by illness, hurt in accident (for drugs only), spouse left, DWI arrest, incarceration, fights, arrest for nondriving drinking or drug incident, not getting promoted, and being detoxified.

- **Productivity Loss**--being late for work or leaving early, not coming to work at all, being drunk or high at work, performing below a normal level of productivity because of alcohol or drug use or the aftereffects or illness resulting from drinking or drug use.

- **Dependence**--unable to remember some things done while drinking the day before, had shakes because of drinking or hands shook a lot after drinking the day before, could not stop drinking before becoming drunk, took drink first thing when got up.

All three measures were computed for alcohol use. Only measures of productivity loss and serious consequences were computed for drug use because the small number of drug users did not yield large enough numbers for analysis of those who were drug dependent. The indexes of serious consequences for alcohol use and for drug use show the percentages of personnel who reported any occurrence of the problems captured by the items. The productivity loss indexes assess time lost from work due to alcohol use or drug use and indicate the percentage of military personnel with any such loss.

The dependence measure is the estimated number of days on which each symptom occurred during the past year. These frequencies are then summed over the four symptoms, and individuals with scores of 48 or more are classified as dependent.

Estimates and standard errors were computed using RATIO2 and SURREGR, software packages developed by Research Triangle Institute to analyze survey data that use complex sampling designs (Wheeless and Shah, 1982). T-tests were used to assess the significance of differences between prevalence estimates for the four survey years.

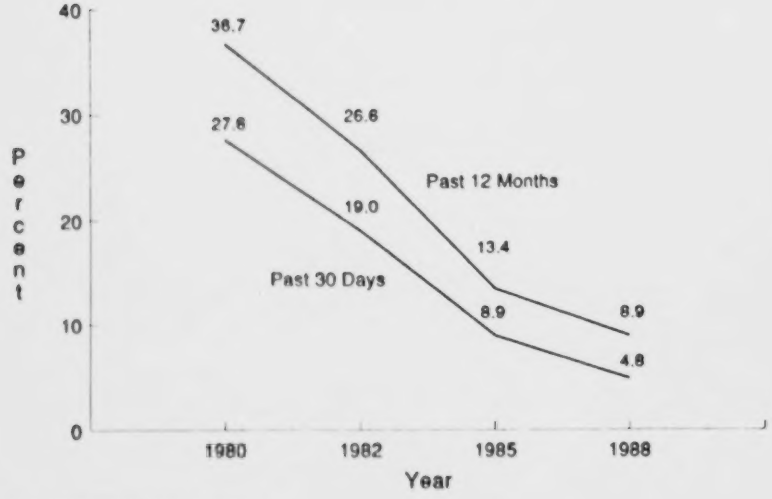
FINDINGS

We examine here the impacts of drug and alcohol abuse on the military workplace as well as the impact of the military on drug and alcohol use. We first examine the extent of drug and alcohol use among military personnel across the world in 1988 and trends since 1980.

Trends in Drug and Alcohol Use

Figure 1 presents the changes in the prevalence of drug use among military personnel between 1980 and 1988. As shown, the percentage of military personnel who used any drug during the past 12 months or past 30 days decreased dramatically over the 8 years. Any drug use in the past year decreased from 36.7% in 1980 to 8.9% in 1988; 30-day drug use was 27.6% in 1980 and 4.8% in 1988. The declines in any drug use over the 8-year period and between each of the survey years were statistically significant for use during the past 12 months and the past 30 days.

Figure 1. Trends in Any Drug Use, Past 12 Months and Past 30 Days, Total DoD, 1980-1988

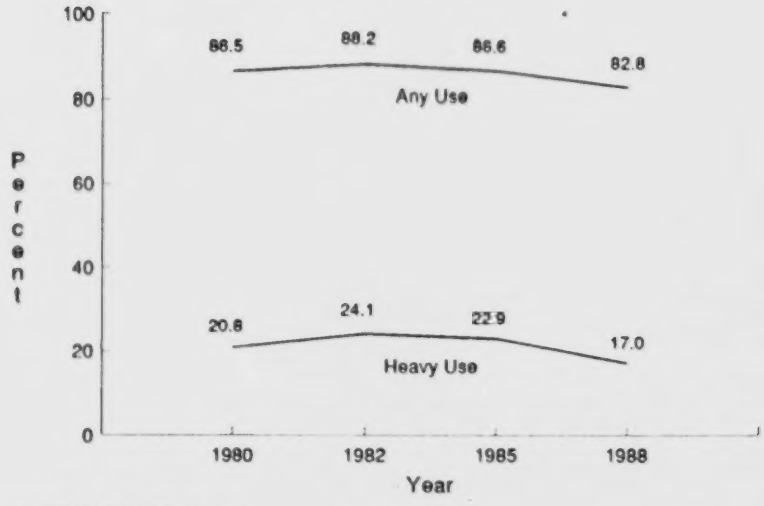


Source: 1988 Worldwide Survey.

As shown in figure 2, there were also decreases in any alcohol use and heavy alcohol use between 1980 and 1988, but decreases were relatively small and occurred mainly during the latter part of the period. The percentage of military personnel who used alcohol declined slightly over the 8 years, from

86.5% in 1980 to 82.8% in 1988. The percentage using alcohol increased slightly, but significantly, between 1980 and 1982, declined to the 1980 level in 1985, and then decreased significantly between 1985 and 1988 to a level lower than in 1980. Heavy alcohol use followed the same general pattern as any alcohol use. Over the 8 years, the percentage who were heavy drinkers decreased significantly from 20.8% in 1980 to 17.0% in 1988.

Figure 2. Trends in Alcohol Use, Past 30 Days, Total DoD, 1980-1988



Source: 1988 Worldwide Survey.

The 1988 drug and alcohol use levels were the lowest since 1980. While drug use decreased sharply during the 1980s, alcohol use was more stable, and most of the decreases occurred during the latter part of the period. These findings suggest that the intense military effort to eliminate drug abuse that began during the early 1980s has been largely successful. According to the Worldwide Surveys, drug use among military personnel, although still a problem, is now relatively low. The military's efforts to control alcohol abuse, in contrast, have been less successful. The finding that the decreases in alcohol use occurred during the latter part of the period and were less dramatic than for drug use suggests that military efforts to limit alcohol abuse have been more recent and perhaps less intense.

Due largely to successes in recruiting and retention, the military force is somewhat older, has more officers and more married personnel, and is better educated than in 1980--factors associated with lower levels of drug and

alcohol use. To examine whether changes in use between 1980 and 1988 were related to changes in the demographic composition of the military population, we standardized rates of drug use and heavy alcohol use in 1982, 1985, and 1988 to the 1980 age/education/marital status distribution of the military. Standardized estimates were found to be similar to unstandardized estimates and to show the same patterns of change. Thus, observed changes among military personnel in drug and alcohol use during the 1980s are not accounted for by shifts in the demographic composition of the military population (Bray et al., 1988).

Although changes in drug and alcohol use among military personnel are not attributable to demographic changes, they partly reflect similar changes occurring for civilians. The use of most drugs among civilians declined during the 1980s, while alcohol use was more stable (NIDA, 1989; Hilton and Clark, 1987). Comparisons of the rate of change among military personnel and civilians suggest, however, that the rate of change in drug use was greater among military personnel than civilians during the 1980s (Bray, Marsden and Wheeless, 1989). The declines in drug use were particularly large after the institution of the policy of zero tolerance in 1981.

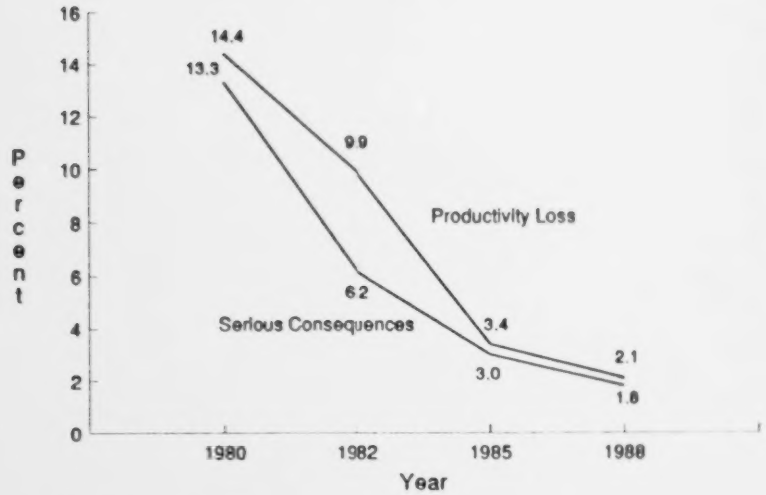
The increases in any alcohol use and heavy alcohol use among military personnel between 1980 and 1982 may reflect a substitution of alcohol for drugs. That is, some military personnel may have ceased using drugs when urinalysis testing began during 1981, but compensated by increasing their alcohol use. If so, the switch was only temporary because, as shown in figures 1 and 2, both alcohol and drug use have declined since 1982.

Trends in Negative Effects of Drug and Alcohol Use

Consistent with declines in drug and alcohol use between 1980 and 1988 are similar declines in the negative effects experienced by military personnel as a result of their drug and alcohol use. Figure 3 shows substantial declines in the percentage of military personnel reporting serious consequences and productivity loss associated with drug use between 1980 and 1988. All but one change between the survey years was statistically significant. The percentage of military personnel reporting either serious consequences or productivity loss associated with drug use during the past year declined from 13 or 14% in 1980 to about 2% in 1988.

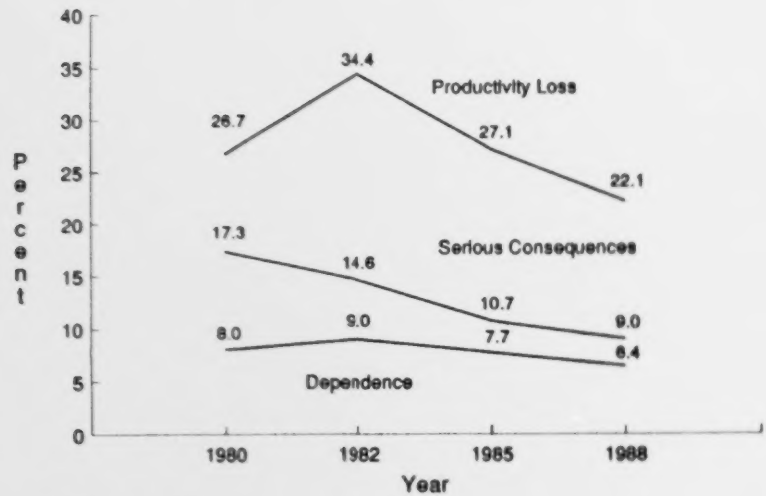
Figure 4 indicates that decreases in serious consequences, productivity loss, and dependence associated with alcohol use were also apparent between 1980 and 1988. The percentage of military personnel experiencing serious consequences associated with alcohol use declined from 17.3% in 1980 to 9.0% in 1988; the percentage reporting any productivity loss declined from 26.7% to 22.1%; and the percentage reporting symptoms of dependence declined from 8.0% to 6.4%. The declines for the 8-year period were statistically significant for all three measures, although not all the decreases between the individual survey years were statistically significant.

Figure 3. Drug Use Negative Effects, Past 12 Months, Total DoD, 1980-1988



Source: 1988 Worldwide Survey.

Figure 4. Alcohol Use Negative Effects, Past 12 Months, Total DoD, 1980-1988



Source: 1988 Worldwide Survey.

Effects of Drug and Alcohol Use on Work

Figure 3 illustrates a dramatic decline in drug-related negative effects between 1980 and 1988. Figure 4 illustrates a less dramatic but by no means unsubstantial decrease in alcohol-related negative effects. The level of negative effects associated with alcohol use in 1988, however, indicates that military personnel still experience substantial work-related problems. Table 2 shows more specific types of alcohol-related negative consequences directly and indirectly affecting the work performance of military personnel.

Table 2. Alcohol Use Negative Effects, Past 12 Months, Total DoD

Indicator	Percentage[a]
Serious Consequences	
Received UCMJ Punishment	1.8
Loss of 3 or More Workdays	2.9
Illness Kept From Duty 1 Week or More	0.5
Spouse Left	0.3
Arrested for Driving While Intoxicated	2.1
Arrested for Nondriving Incident	1.3
Incarcerated	1.2
Fights	3.1
Did Not Get Promoted	0.8
Entered Rehabilitation or Treatment Program	0.7
Any Serious Consequences[b]	9.0
Average Number of Consequences	0.15
Productivity Loss	
Any Time Lost	22.1
Average Days Lost	0.38
Dependence	6.4

[a]Table values are percentages except for average number of consequences and average days lost, which are mean values. Estimates are based on responses from 18,673 military personnel.
[b]One or more occurrences of any of the items in the set.
Source: 1988 Worldwide Survey.

As shown in table 2, 22.1% or about one in five military personnel lost productivity at work because of alcohol use, on average almost half a day of work a year. Fewer respondents reported specific serious consequences, but a number of the consequences concerned problems at work, ranging from not getting promoted to receiving military punishment because of their alcohol use.

Ten percent of military personnel drink immediately before or during work hours (table 3). This behavior puts them at risk for alcohol-related problems. The percentage drinking at such times is slightly lower among officers than enlisted personnel, indicating officers have a lower risk of alcohol-related problems at work.

Table 3. Alcohol Use on Work Days, Past 30 Days

Drinking Occasion	Grade		Total
	Enlisted	Officers	
Within 2 Hours of Going to Work	5.5	1.2	4.8
During Lunch Break	6.8	6.6	6.8
During Break or Work Break	2.3	0.9	2.0
Total	**10.4**	**7.9**	**10.0**

Note: Entries are percentages of total personnel. Estimates are based on responses from 18,574 military personnel.
Source: 1988 Worldwide Survey.

Thus, alcohol use has negative effects on the productivity and work behaviors of military personnel, but drug use is now affecting the work of relatively few. As shown in table 4, however, the nature and severity of drug use and alcohol use are predictive of productivity loss in the military workplace. Two regression analyses that excluded nonusers of drugs and alcohol examined factors associated with loss of productivity. Independent variables included either drug use or alcohol use for the respective analyses as well as selected demographic characteristics and indicators of military life. Military service, family status, military rank, and drug use were significant predictors of drug-related productivity loss, while military service, sex, family status, age, stress, and drinking level were significant predictors of alcohol-related productivity loss. More specifically, drug use pattern, dichotomized as use of marijuana

Table 4. Parameter Estimates of Regression Models Predicting Productivity Loss Associated with Drug Use and Alcohol Use, Past 12 Months

Independent Variables	Productivity Loss	
	Drug Use (N=931)	Alcohol Use (N=15,095)
Service		
Army vs. Air Force	0.081*	0.043**
Navy vs. Air Force	0.143*	0.087**
Marine Corps vs. Air Force	0.203	0.113***
Race/Ethnicity		
Black vs. White	0.080	-0.024
Hispanic vs. White	0.007	-0.007
Other vs. White	0.016	-0.054
Sex		
Male vs. Female	0.071	0.039*
Education		
High School or Less vs. More	-0.008	0.010
Family Status		
Single vs. Married, Spouse Present	0.068	0.093***
Married, Spouse Absent vs. Married, Spouse Present	0.174*	0.127**
Region		
North Pacific vs. Americas	-0.059	-0.015
Other Pacific vs. Americas	-0.075	0.008
Europe vs. Americas	0.036	-0.006
Rank		
Officer vs. Enlisted	-0.159**	-0.018
Age	-0.004	-0.008***
Stress	0.045	0.029***
Drug Use		
Marijuana vs. Other	-0.159*	---
Drinking Level		
Heavy vs. Infrequent/Light	---	0.338***
Moderate/Heavy vs. Infrequent/Light	---	0.144***
Moderate vs. Infrequent/Light	---	0.008

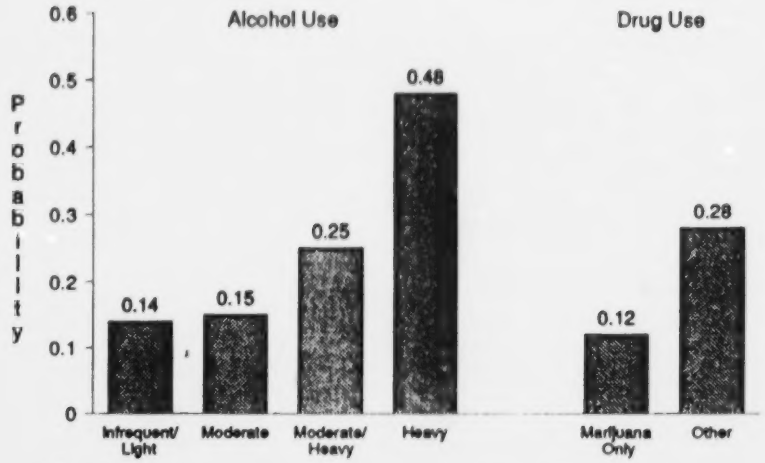
Note: Entries are regression parameters that indicate the effects of the independent variables on the probabilities of productivity loss during the past 12 months due to drug use or alcohol use.

*p<.05.
**p<.01.
***p<.001.

Source: 1988 Worldwide Survey.

only versus other drug use patterns, was significantly related to productivity loss attributed to drug use. Those using only marijuana were significantly less likely than other drug users to report productivity loss. Similarly, drinking levels were related to productivity loss. Heavy and moderate/heavy drinkers were significantly more likely than infrequent/light drinkers to experience alcohol-related productivity loss. Figure 5 illustrates these differences, presenting the adjusted means for productivity loss for the various levels of drug and alcohol use.

Figure 5. Probability of Productivity Loss During the Past 12 Months for Alcohol and Drug Use Levels



Note: Scores have been adjusted for effects of all other variables in the regression models shown in Table 4.
Source: 1988 Worldwide Survey.

Effects of the Military on Drug and Alcohol Use

The military has responded to the negative effects of drug and alcohol use on work performance and military readiness by issuing a series of policy directives that set forth the military position on drug and alcohol abuse and actions to be taken to eliminate abuse. The Services follow a policy of zero tolerance of illicit drug use and a policy of responsible use of alcohol. Although alcohol use is legally and socially accepted, on-duty impairment is not tolerated. Violations of alcohol and drug abuse policies are grounds for military sanctions, including discharge from the armed forces for drug offenses. These policies are clearly aimed at eliminating drug use and alcohol misuse. As noted earlier, the stringent drug abuse policies have likely resulted in substantial decreases in drug use during the 1980s, but the less

intense efforts directed toward alcohol abuse are reflected in more stable rates of alcohol use.

Aspects of the military job and military life may encourage drug and alcohol use, offsetting some of the positive effects of military drug and alcohol abuse programs. In regression analyses, we examined the relationship between drug and alcohol use and three conditions of military life: job-related stress, location of duty assignments, and family status. Personnel may use drugs or alcohol to cope with job-related stress. For these analyses, the job stress measure is a five-point scale that indicates the level of stress the respondent attributed to the job. The scale ranges from none at all to a great deal in the past 30 days.

Drug and alcohol use may be associated with location of military duty assignment. Many have argued that being overseas, away from family and home, creates conditions conducive to drug and alcohol use. Indeed, one of the major impetuses for the development of military policy on drug abuse was the concern that U.S. military personnel would continue their drug use after returning from Vietnam (reviewed in Ritter et al., 1985). Location of duty assignment is the region where military personnel are stationed: the Americas, North Pacific, Other Pacific, or Europe.

Both drug and alcohol use are expected to be more common among single persons and married persons unaccompanied by their spouse on their duty assignment than among married persons who are accompanied by their spouse. The stability of marriage, particularly the family support of having the spouse present, is expected to be related to lower rates of use. Here we examine the relationship between drug and alcohol use, and family status, which is defined as being single, being married with spouse absent, and being married with spouse present.

Table 5 presents the regression analyses used to investigate the relationship between these indicators of military life and any drug use and involvement in heavy drinking. Other demographic characteristics and indicators of military life were included in the analyses to control for certain subgroup differences associated with use. Results show that certain conditions of military life are related to greater involvement in use of drugs and alcohol. Work-related stress, region, and family status are significant predictors of both any drug use and heavy drinking. More specifically, heavy alcohol use is significantly greater among those who report feeling greater stress at work, who are stationed in Europe (compared with the Americas), or who are single (compared with those who are married with spouse present). The effects for family status are very large, whereas the effects for region and stress are relatively small.

Drug use is higher among those who report feeling more job-related stress or who are single compared with those who are married with spouse present. Overseas regions show a pattern of lower drug use than in the Americas, but only drug use in the North Pacific is significantly lower. As with alcohol use, the effects for family status are large, whereas the effects for region and status are relatively small.

Table 5. Parameter Estimates of Regression Models Predicting Any Drug Use and Heavy Drinking, Past 30 Days

Independent Variables	Any Drug Use (N=18,479)	Heavy Drinking (N=18,479)
Service		
Army vs. Air Force	0.041***	0.029*
Navy vs. Air Force	0.018*	-0.039
Marine Corps vs. Air Force	0.001	0.040
Race/Ethnicity		
Black vs. White	-0.010	-0.060***
Hispanic vs. White	-0.003	-0.041*
Other vs. White	-0.007	-0.032
Sex		
Male vs. Female	0.004	0.124***
Education		
High School or Less vs. More	0.014*	0.067***
Family Status		
Single vs. Married, Spouse Present	0.042***	0.103***
Married, Spouse Absent vs. Married, Spouse Present	0.016	0.031
Region		
North Pacific vs. Americas	-0.030***	0.031
Other Pacific vs. Americas	-0.006	0.071
Europe vs. Americas	-0.004	0.041**
Rank		
Officer vs. Enlisted	-0.022***	-0.083***
Age	-0.002*	-0.003***
Stress	0.008**	0.012*

Note: Entries are regression parameters that indicate the effects of the independent variables on the probabilities of any drug use and heavy drinking during the past 30 days.

*p<.05.
**p<.01.
***p<.001.

Source: 1988 Worldwide Survey.

Some of these conditions are amenable to change through military policy such as the policy of spousal accompaniment. Although the relationships were not significant, there was a pattern for a greater percentage of married personnel with spouse absent to use drugs or engage in heavy alcohol use than married personnel with spouse present. Other conditions, such as the region of the world in which military personnel are stationed, may not be as amenable to change; but study results may signal areas that social programs should target. Both drug use and heavy alcohol use are related to reported job stress, a condition that may be modified using stress management techniques.

DISCUSSION

Findings from the 1988 Worldwide Survey on Substance Abuse and Health Behaviors Among Military Personnel indicate that drug use among military personnel has declined dramatically since 1980 when the survey series began. Alcohol use, however, has been more stable. These changes in substance use have been accompanied by substantial decreases in drug-related negative effects and smaller decreases in alcohol-related negative effects. In 1988, 2% or fewer military personnel reported drug-related negative effects, while approximately 22% reported they had experienced alcohol-related productivity loss, 9% serious consequences, and 6% symptoms of dependence. Many of these negative effects are indicators of compromised work performance.

A stringent military policy against drug abuse is often credited with these decreases in drug use and drug-related negative effects. The military policy of zero tolerance clearly states that drug use will not be tolerated. Identified users are subject to discharge from the military. Although there are some variations in enforcement of the policy among the military Services, officers and noncommissioned officers are generally processed for discharge for one drug-positive urine specimen or any drug offense. Junior enlisted personnel are given one chance to change their drug use behavior and are processed for separation after a second offense.

Beginning in 1981, the policy of zero tolerance was coupled with urinalysis testing to monitor and deter drug use. A recent analysis by Bray, Marsden, and Wheeless (1989) shows that drug use is substantially lower among military personnel than among comparable civilians. Their study also shows that drug use among military personnel declined rapidly after urinalysis testing began, and that drug use among military personnel during the 1980s declined much more rapidly than among civilians. These results suggest that the military policy toward drug use has been effective.

The emphasis on decreasing alcohol abuse is more recent, and there have been sizable decreases in use only in the past few years. Beginning in the mid-1980s attention was directed to deglamorizing alcohol use. "Happy hours" that feature reduced prices for alcoholic beverages have disappeared from service clubs, serving of beer as a reward for good performance is discouraged, and nonalcoholic alternatives are now provided whenever alcohol is served. Despite these efforts to discourage alcohol use, military personnel may receive a mixed message about drinking. On the one hand, use is formally discouraged in a variety of practices and programs in the military. On the other hand, the price of alcohol is still discounted at service exchanges, a practice that may encourage use or increase the frequency or level of use.

These trends in drug and alcohol use indicate the need for the military to continue the policies proven to be effective against drug abuse and to intensify its policies directed toward decreasing alcohol abuse. The military could examine its policies on spousal accompaniment to provide the stability of family support whenever practical and evaluate the stress-producing conditions of certain military jobs. Further, the military could intensify its efforts toward helping military personnel effectively cope with stress by offering additional stress management instruction.

These findings indicate the substantial effects that alcohol use, (and to a lesser degree, drug use) has on military performance and, conversely, the role that military life and military policy may play in encouraging military personnel to use alcohol and drugs. The findings suggest the need for more detailed study of the effects of alcohol and drug use on sensitive or high-risk positions within the military and the ways in which the military can lower the impact of alcohol and drug use on military preparedness.

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Patterns of Drug Use in a Large Metropolitan Workforce

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INTRODUCTION

Concern over drug abuse in the United States workforce has increased in recent years because of its serious implications for worker productivity and health. The root causes of this growing problem are undetermined, but they presumably involve increased social acceptance of some forms of illicit drug use, increased availability of drugs, and influential factors in the workplace such as stress or boredom. Although very little objective data are available, there is a significant national trend in private industry and in the government toward implementing mandatory drug-testing programs. More than 25 percent of major United States corporations currently use some form of employee screening for illicit drugs, and the President's Commission on Organized Crime recently endorsed such testing for government employees as well as for those companies performing government contracts.

Much of the current attention to drug testing in industry focuses on legal implications as well as the technical validity and reliability of drug-testing procedures for laboratory analysis of urine or other body fluid specimens. Looming behind these concerns, however, are more fundamental questions about the actual prevalence of drug use in the workplace, its impact on employee job performance (including health-related costs), the etiological factors which contribute to drug use in industry, and whether drug-testing procedures are effective deterrents. Although empirical evidence on these questions is beginning to accumulate, final conclusions about the cost-effectiveness and appropriateness of massive drug-testing efforts are still premature.

The cost of drug use and abuse for industry is thought to be very large, even though there is no consensus about what that estimate might be. Accidents, health and welfare services, workman's compensation, insurance claims, and property damages are among the major direct costs that are usually associated with drug abuse (Stephen and Prentice, 1978). Loss of productivity and thefts result in indirect costs that are difficult to quantify. Without having reasonable estimates for prevalence of use, however, accurate computations of related costs to industry become almost impossible. Costs

of drug abuse to industry are also usually quoted for industry as a whole, without taking into consideration the different types of industries involved. Several models are available to estimate the prevalence and impact of drug use in the workplace, although each has its own strengths and limitations. These models involve: (1) self-report population or household surveys, (2) urine screen results, (3) EAP referrals, and (4) self-report employee surveys within an organization. The population survey, which generally uses a stratified random sampling process of households, is useful for assessing drug and alcohol abuse across a wide variety of jobs and work situations, but does not provide prevalence or impact data for single organizations. Although the data obtained are limited by reliability issues associated with self-reporting of sensitive behaviors such as drug abuse, responses are not linked to a specific employer and are not likely to be affected by job security concerns.

The other three models can be used to assess prevalence and impact of drug abuse within single organizations. Assessment of drug use prevalence via employee urine testing has the advantages of objective and accurate classification, but is limited to recent drug use (usually within the last 48 hours, except for marijuana) and does not identify long-term or other patterns of use or whether intoxication or impairment occurs in the workplace. Although the model has been successful in some longitudinal studies of new hires, it is difficult to get current employees to voluntarily participate in a study that can link urine specimens to individual responses.

The model based on EAP referrals can be used to assess some of the costs and impact of drug abuse in the workplace by comparing employee costs and productivity of referred and non-referred employees, or by comparing histories of referred employees before and after EAP interventions. However, the model does not assess prevalence or impact of undetected drug use among employees. It is also strongly dependent on the presence and structure of EAP's and on the quality of supervisor training in identifying potentially impaired employees.

The fourth model relies on self-report surveys within an organization or group of organizations. A wide variety of drug use patterns, both at and away from the worksite, can be assessed and related to employee characteristics, work environment, and job performance. The model is limited, however, by reliability concerns associated with self-report drug use behaviors, which may be exacerbated by fears of job security if organization officials gained access to individual responses.

The self-report survey model described above was chosen for the current study of municipal employees in a large southwest city because of the interest in estimating the prevalence of all patterns of drug and alcohol abuse within a single organization, and examining antecedents and consequences of drug use in that organization. However, recognition of several inherent reliability

problems associated with self-report data on socially unacceptable behaviors caused special attention to be given to issues of confidentiality and anonymity of the surveys and to the need for using multiple methods for estimating prevalence rates.

The current study, therefore, combines three different methods of assessing drug and alcohol use prevalence in the workforce: (1) self-report, (2) perceptions of use among coworkers, and (3) urine screens. The self-report questions are the most direct way of obtaining information on a variety of drug use patterns although it is expected that, even with careful assurances of confidentiality and anonymity of the data, drug use will be under-reported. Asking respondents about drug use among coworkers gives users a chance to provide information on drug use prevalence without necessarily implicating themselves personally, and gives non-users a chance to express their perceptions on possible drug abuse episodes they have witnessed among coworkers. And finally, information obtained from urine screens will provide objective data on recent drug use and can be used to help validate self-report information.

Using these three means of estimating drug use, the study addresses five major aspects of drug use, including alcohol, in the work setting of municipal employees. These include (1) prevalence of drug use by employees while off-the-job as well as while in the workplace, (2) employee sociodemographic and background characteristics which are related to drug use, (3) work environment characteristics which are related to employee drug use, (4) employee performance indicators which are related to drug use, and (5) validation of self-reported drug use data via urinalysis. The comparative influence of selected employee characteristics and work environment measures on drug use and job performance will also be studied in an analytic model represented by a system of linear structural equations. The analyses reported below are from the first phase of this project and emphasize prevalence rates for several employee characteristics on a preliminary sample.

METHODS

Sample Selection

The survey is being conducted in a large southwest city which employs close to 10,000 employees in a wide variety of jobs. Of these, more than 4,000 are sworn police and fire officers who were not included in the study because of differences in drug policies, job characteristics and requirements, and union policies as compared with the rest of the municipal workforce. The remaining population of approximately 5,800 employees was the focus of a stratified random sampling plan. Data collection involves anonymous self-report questionnaires, generally lasting up to 1 hour for employees to complete in

group settings. As explained in more detail below, urinalyses to detect recent drug use are based only on 25 percent of the survey sample.

Of the 5,800 employees in the sampling, 67 percent are male and 33 percent are female. A large majority of workers (69 percent) are Hispanic, primarily Mexican-American, 20 percent are white, and 10 percent are black. In terms of age, 26 percent are between 21 and 30 years, 35 percent are between 31 and 40, 19 percent are between 41 and 50, and 20 percent are above the age of 50. Overall, the mean salary of city workers is $17,818 and the mean years of employment with the city is 8.3.

Survey administration began in May, 1989, and will continue until a sample of 2,000 surveys are completed (expected by the end of October, 1989), representing about 34 percent of available employees. This sample size is expected to provide stable prevalence estimates for specific subgroups of employees and to provide cross-validation samples for hierarchical regression and LISREL analysis. In an effort to minimize employee reactions or concerns about being selected for participation in this study, entire working units were randomly selected rather than designated sampling from individual employees within departments. For this procedure, the city workforce was divided into 248 mutually exclusive and exhaustive workgroups (ranging in size from 5 to 70) based on departmental organizational structure (divisions or sections within departments). By necessity, the precise definition of a workgroup varied across and sometimes within departments and in some cases was defined by physical location, job types, or shifts. This procedure is less "discriminatory" from the perspective of individual employees. It is also efficient in terms of administering self-report questionnaires since the entire workgroup (instead of only a small percentage) is included. It likewise provides more thorough and integrated information on perceptions concerning coworkers and the work environment within each employee unit or department.

1. Employee Classification

Employees are currently grouped into eight specific EEO job categories. For purposes of the sampling plans and data analysis, these categories are collapsed into four basic job classes--Official/Professional (17 percent), Skilled/Technical (30 percent), Clerical (17 percent), and Paraprofessional/Services (36 percent).

- **Official/Professional** -- include department and division heads, managers, administrators, lawyers, superintendents, and health professionals.

- **Skilled/Technical** -- include trained mechanics, data analysts, systems analysts, data processors, appraisers, security personnel, park rangers, and others.

- **Clerical** -- include secretaries, word processors, stenographers, and clerks.

- **Paraprofessional/Services** -- include health and legal aides, truck drivers, sanitation workers, laborers, park attendants, cashiers, and others.

Employee Questionnaires

The major source of data for the study involves self-report questionnaires **administered anonymously** to individual employees in selected workgroups. Assurances of complete anonymity of employee responses is necessary for maximizing respondent self-disclosure. Questionnaires are administered in groups of five to 70 employees at a time (although typically in the range of 10-30) by a representative of the Institute of Behavioral Research (IBR) from Texas Christian University. In order to ease concerns of employees who may feel uncomfortable taking a sensitive survey in the presence of their superiors, supervisor groups are generally surveyed separately. The completed questionnaires in each session are returned directly to the IBR representative. City representatives *never have access* to individual employee responses.

A standard set of instructions is read to respondents by the IBR field representative to describe the purpose of the study and confidentiality procedures used to protect employee anonymity. The importance of obtaining accurate information about drug use, factors related to drug use, and the effect of drug use on productivity and worker safety is emphasized. Workers are encouraged to let management know how they feel about drug use in their workgroups and about their attitudes toward their current drug policies and sanctions. Confidentiality procedures are carefully explained, and it is stressed that information will not be released in any way that can identify individual respondents. Letters of endorsement and support from both management and employee union representatives have been used to enhance participation.

The questionnaire addresses eight general content areas: (1) employee socio-demographic background, (2) perceptions of the work environment, (3) job satisfaction, (4) psychological well-being, (5) job performance indicators, (6) perceptions of coworker's drug use, (7) attitudes towards drug testing and drug policies at work, and (8) self-reported drug use. Each one is summarized below.

1. Sociodemographic Background

Sociodemographic data include basic information on age, sex, race, educational level, marital status, and number of children as well as other background data on health status and family relations. Data collected on job background include job classification, salary level, job tenure, tenure with the organization, and job classification.

2. Perceptions of the Work Environment

Several factors of the perceived work environment are measured which have been implicated in other research as job-based risk factors in employee drug use. Measures for the present study have been adapted from pre-existing scales found in the work environment literature to assess perceptions of leadership, workgroup and peer relations, pay equity, loyalty, and physical working conditions.

3. Job Satisfaction

Assessment with the Minnesota Satisfaction Questionnaire Short Form (Weiss et al., 1967) uses 20 items, each measuring a different job-related facet. Areas represented include satisfaction with pay, working conditions, leadership, co-workers, city policies, and feelings of accomplishment. Responses to the 20 items sum to form an overall job satisfaction index.

4. Psychological Well-Being

Several measures have been included to measure psychological well-being at work and at home, adapted from several previously developed scales. These represent (1) self-esteem at work (Quinn and Shepard, 1974), (2) job-related tension (Kahn et al., 1964), (3) job involvement (Lodahl and Kejner, 1965), and (4) powerlessness (Shepard, 1972).

5. Job Performance Indicators

Self-report measures of performance include major withdrawal behaviors such as absenteeism, lateness, sick days used, and intentions to quit, and organizational costs such as accidents at work, worker's compensation, and health insurance claims. In addition, a variety of items have been included to assess other forms of psychological work withdrawal, such as moonlighting on the job, daydreaming and sleeping at work, excessive nonproductive chatting with other employees, and performing personal tasks at work.

Positive productive behaviors reflect doing more work than expected, staying late, and obtaining additional training or education.

6. Perceived Drug Use Among Coworkers

Employees are asked about the prevalence and effects of drug and alcohol use among their unnamed coworkers in their immediate work group. Questions about drug use by others were constructed to address (1) the percentage of workers who recognize drug and alcohol use by others in the workplace, (2) the prevalence of coworker drug use (e.g., alcohol, marijuana, minor tranquilizers, sedatives, uppers, cocaine, other drugs), (3) consequences of coworker drug use in terms of the respondent's own safety and productivity, and (4) perceived causes of drug or alcohol use in the workplace.

7. Attitudes Toward Drug Policies and Drug Testing

Attitudes are assessed toward drug testing and various types of drug policies such as random testing of all employees, pre-employment screening, increased training and education, and establishing EAP programs. Additional items measure employee responses to perceived, or known, drug use in the workgroup, and satisfaction and knowledge of city policies.

8. Self-Reported Drug Use

Finally, employees are asked directly if they have ever used certain licit and illicit drugs (e.g., cigarettes, alcohol, over the counter drugs, prescription drugs, marijuana, cocaine, amphetamines, barbiturates, others) during their lifetime, in the last year, and in the last month. They are also asked about personal drug use and being under the influence of drugs while at work in the last year.

Urinalysis

To verify and validate self-reported drug use and to provide an independent prevalence estimate of recent drug and alcohol use, urine specimens are being obtained and tested for a sample of 500 (25 percent) respondents. Again, to guard against the impressions of selective "discrimination," individual employees within departments or workgroups are not being singled out for urine screens. Instead, a novel method is being tested wherein urines are requested for entire workgroups, determined on a random basis to insure representation across departments and employee classifications.

In order to protect and ease concerns about anonymity of results, urine specimens *are not linked to individual questionnaires*. Procedurally, all employee respondents in every session return their completed questionnaire

to the IBR representative located outside of the survey administration room. For those particular workgroups randomly selected for urine collections, all employees are given a specimen bottle in a brown paper wrapper before returning the completed questionnaire. They are then asked to stop by the restroom (as an incentive, they receive $5.00 to provide a specimen) and then turn in their completed survey and specimen bottle at a second station. At the second station, an IBR representative collects the completed survey and discretely inspects the specimen bottle. All respondents then receive an envelope containing a letter thanking them for their participation, and a $5.00 bill if a urine specimen was provided. The completed survey is then marked according to whether or not a urine specimen was given.

Using these procedures, *a group of urine specimens* will be linked to *a group of questionnaires* from those employees who agreed to provide urines, but no individual questionnaire can be linked to an individual urine sample (special precautions are used for small groups). Validation of self-reported use will, therefore, be restricted only to those employees who agree to provide a urine sample and will be based on aggregated group percentages. Although the validation analyses will not be as powerful as if individual questionnaires were linked to specific urine specimens, these procedures were necessary to insure adequate protection and gain the necessary participation rate.

Urinalyses are being conducted by the local medical examiner's office. The laboratory utilizes an Abbott TDX system which uses fluorescence polarization immunoassay (FPIA). This system offers relatively high accuracy and a low incidence of false positives, and is used for initial screens. All positives are confirmed using gas chromatography/mass spectrometry (GC/MS). Screens and confirmations are being conducted for marijuana, morphine, amphetamines, cocaine, benzodiazepines, and alcohol (detectable for up to 12 hours after heavy use).

Survey Administration Procedures

Survey administration procedures were designed to maximize employee participation, using strict controls on confidentiality and anonymity of survey responses. All fieldwork activities, including scheduling, survey administration, and processing of completed forms and collected urines are conducted by IBR field staff.

All surveys collected are *identified only by a workgroup identification number* never by name or any individual identification number. However, in order to protect the identities of individuals within small workgroups, data reported back to city officials will be aggregated by departments, job classifications, or other factors that would not allow specific identification of these small departments or workgroups.

Employees are informed by letter and public notices of the purpose of the study and procedures to be followed at least 2 weeks before being asked to

participate. Only IBR staff are directly involved in the data collection process, and they carefully explain the study and procedures. The fieldwork team includes at least two members at each data collection session, and city employees or workgroup supervisors *are not* directly involved in any part of the data collection or processing.

Participation by employees is strictly voluntary and all questionnaire sessions are completed during regular working hours. The actual time selected for completing the questionnaire is determined in part by department and employee work schedule.

RESULTS

The analyses presented here are based on a preliminary sample of 993 completed questionnaires from 70 workgroups. A total of 195 employees chose not to complete the survey, resulting in a participation rate of 84 percent. Urines were provided by 126 out of 180 respondents from 15 groups, for a participation rate of 70 percent (and results from the urinalyses are not available at this time).

Demographic and job background profiles of the sample are presented in table 1, grouped by job classification. The overall distribution of job classifications shows that 21 percent are classified as official/professional, 22 percent are skilled/technical, 16 percent are clerical, and 41 percent are paraprofessional/service.

Demographic distributions show that the sample is relatively evenly split between the age groups of 17 to 30, 31 to 40, and 41 to 70 years (29 percent, 36 percent, and 35 percent respectively). The sample was 65 percent male and predominantly Mexican-American (70 percent), with a lower proportion of whites (23 percent) and blacks (7 percent). Approximately 21 percent of the sample had less than a high school education and 22 percent had college degrees or higher; over one-fourth of the sample (28 percent) earned less than $13,000 per year and one-third earned in excess of $20,800 annually. Two-thirds of the sample were paid hourly wages with the remaining one-third on regular salary.

Cross-tabulations of these variables within job classifications shows that the official/professional group (compared to others) tends to be slightly older (44 percent over 40), is overrepresented by whites (52 percent), is more highly educated, and receives higher pay. The skilled/technical classification is predominantly male (84 percent) with high school diplomas or some college or technical training (77 percent) who are paid hourly wages (80 percent) toward the middle of the pay scale. Clerical workers tend to be young (39 percent are 30 or younger), almost exclusively female (89 percent) with high school educations (98 percent), the majority has some college or technical training (63 percent), and mostly Mexican-American (81 percent).

Paraprofessional/service employees tend to be Mexican-American (82 percent) males (82 percent) with relatively low levels of education (45 percent with less than a high school education). The vast majority of them are on hourly wages (83 percent) toward the bottom of the pay scale.

Table 1. Sample Characteristics by Job Classification

	Job Classification				
	Offic/Prof	Skill/Tech	Clerical	Para/Serv	TOTAL
Age					
17-30 Years	13	27	39	35	29
31-40 Years	43	34	41	31	36
41-70 Years	44	39	20	34	35
Gender					
Male	53	84	11	82	65
Female	47	16	89	19	35
Race					
Black	4	9	9	7	7
Mexican-American	44	64	81	82	70
White	52	27	10	10	23
Education					
Less than H.S.	2	9	2	45	21
H.S. Diploma	7	36	34	30	27
Some College	23	41	53	20	31
College Degree	68	15	10	6	22
Salary Level					
Under $13,000	3	15	36	44	28
$13,000-20,800	27	48	48	37	39
Over $20,800	71	37	16	19	33
Pay Status					
Hourly	20	80	68	83	66
Salary	80	20	32	17	34
TOTAL PERCENTAGE OF GROUP					
Group	21	22	16	41	100
Total Number					
In Sample Size	94	208	149	383	934

SELF-REPORTED ALCOHOL AND ILLICIT DRUG USE

1. Alcohol Use

Distributions on self-report measures by age and job classification groups are presented in table 2. For alcohol, the frequency of use measure refers to "any drinking" in the last year. Overall, 23 percent of the sample reported no drinking at all in the last year, while over half (54 percent) drank at least once a month. Frequency of heavy use, as reported in table 2, refers to getting drunk or drinking five or more drinks in a row. Half of the sample reported getting drunk at least once in the last year, with 29 percent getting drunk once a month or more.

Admitting problems refers to having any alcohol-related problems in the last year--that is, DWI, missing work, getting sick, having accidents, getting into fights or arguments, being arrested, or entering treatment for alcohol use. Also included were alcohol-related symptoms such as drinking first thing in the morning, experiencing shakes or tremors, or drinking more than intended. A total of 17 percent of the sample reported some problems with alcohol use in the last year. With respect to drinking on the job (although not shown in the table), 5 percent of respondents admitted to drinking either right before or while at work during the last year.

Alcohol use distributions within age and job classification show differences in drinking patterns associated with both age and job classification. In terms of age, younger employees (17 to 30) were more likely than older employees (41 to 70) to drink regularly (58 percent versus 50 percent monthly or more), to get drunk regularly (34 percent versus 26 percent monthly or more) and to report alcohol-related problems (21 percent versus 12 percent).

Comparisons between job classification groups showed that the official/professional group was most likely to drink at least some (83 percent), but was less likely than the paraprofessional/service group to drink monthly or more (52 percent to 62 percent). The clerical group, which was predominantly female, had the highest percentage of non-drinkers (28 percent) and the lowest percentage of regular drinkers (40 percent monthly or more). Comparisons on frequency of getting drunk and on alcohol-related problems revealed that these more abusive drinking patterns were more prevalent in the lower job classifications such as paraprofessional/service, and less prevalent in the higher job classifications (official/professional). A total of 42 percent of the paraprofessional/service group reported getting drunk at least once a month and 20 percent reported alcohol-related problems. For the official/professional group, 16 percent reported getting drunk at least monthly and 14 percent reported alcohol-related problems. Clerical workers tended to be similar to official/professionals in drinking patterns and the service/technician group tended to fall in the middle.

Table 2. Self-Reported Alcohol and Illicit Drug Use, by Age and Job Classification

	Age Group			Job Classification				
	17-30 Years	31-40 Years	41-70 Years	Offic/ Prof	Skill Tech	Clerical	Para/ Serv	TOTAL
ALCOHOL USE:								
Frequency of Use								
None	17	23	27	17	23	28	23	23
Less than Monthly	24	22	23	31	22	32	15	23
Monthly or More	58	55	50	52	55	40	62	54
Frequency of Heavy Use								
None	41	51	56	59	48	65	40	50
Less than Monthly	25	22	17	25	24	20	18	21
Monthly or More	34	28	26	16	27	16	42	29
Admitting Problems	21	19	12	14	17	12	20	17
ILLICIT DRUG USE:								
Lifetime Use								
Marijuana	36	26	7	26	25	21	21	22
All Other Drugs[1]	17	14	5	16	13	13	10	12
Cocaine	10	7	1	6	7	5	6	6
Last Year								
Marijuana	15	6	2	6	7	6	8	7
All Other Drugs[1]	8	4	1	4	5	5	4	4
Cocaine	6	3	0	2	3	3	3	3
TOTAL PERCENTAGE OF GROUP								
Actual Number								
In Group	29	36	35	21	22	16	40	100
Total Number								
In Sample Size	271	343	329	191	198	146	360	943

[1]Includes cocaine, amphetamines, benzodiazepines, tranquilizers, sedatives, psychedelics, inhalants, and narcotics.

2. Illicit Drug Use

Illicit drug use is reported in terms of lifetime use and last year use of marijuana and other drugs (including cocaine, amphetamines, benzodiazepines, tranquilizers, sedatives, psychedelics, inhalants, and narcotics). Cocaine is also reported as a separate drug category because of the special current interest and attention given to cocaine use, especially among young professionals. A measure of drug-related problems, similar to

that for alcohol reported above, was examined but is not reported here because of extremely low response (less than 1 percent). Tabulations of illicit drug use measures are shown in table 2 by age and job classification groups.

Overall, 22 percent of employees reported lifetime marijuana use and 12 percent reported lifetime use of other drugs. Lifetime cocaine use was reported by only 6 percent of the sample. During the last year, 7 percent reported marijuana use, 4 percent reported other drug use (including, cocaine), and 3 percent reported cocaine use. Although not presented in table 2, 2 percent admitted using drugs while at work in the last year.

As expected, younger employees were much more likely to have used marijuana or other drugs in their lifetime and in the last year. Over one-third of employees aged 30 or younger used marijuana in their lifetime (36 percent) and 15 percent admitted to use in the last year. For those over the age of 40, 7 percent indicated lifetime use of marijuana and 2 percent use in the last year. For other drugs, 17 percent of employees aged 30 or younger admitted to lifetime use and 8 percent use in the last year; this compared to 5 percent lifetime and 1 percent last year for the over 40 age group.

Group differences according to job classifications were somewhat of a surprise. For lifetime use, there was a tendency for the higher job levels (official/professional and skilled/technical) to be more likely to report drug use than the lower job classifications (paraprofessional/service). For example, among official/professionals, 26 percent reported lifetime marijuana use and 16 percent reported other drug use, compared to 21 percent and 10 percent respectively for the paraprofessional/service group. There was virtually no difference between groups for lifetime cocaine use or any drug use in the last year.

The higher levels of lifetime marijuana and other drug use among the official/professional group may also be explained in part by other demographic variables. As described above, this group was more likely to be white and have higher levels of education than the other job classifications. Tabulations of lifetime marijuana use and other drug use by race and education (not reported in table 2) showed that whites (26 percent) were more likely than Mexican-Americans (21 percent) and blacks (21 percent) to report marijuana use and to admit to other drug use (18 percent, versus 11 percent and 9 percent). Education was positively related to lifetime marijuana and other drug use, as 30 percent of college graduates indicated marijuana use and 19 percent other drug use (versus 14 percent marijuana and 5 percent other drug use for those with less than a high school education).

PERCEPTIONS AND ATTITUDES TOWARD SUBSTANCE USE AT WORK

1. Perceptions of Coworker Use

Table 3 presents tabulations based on the percentage of respondents who reported seeing at least one coworker in the last year who used alcohol, marijuana, or other drugs at work, and either gave or sold drugs (dealing) to coworkers while at work. A total of 28 percent of respondents reported being exposed to at least one coworker who drank or was drunk at work in the last year, 16 percent indicated coworker marijuana use, 13 percent claimed other drug use among coworkers, and 16 percent reported coworkers giving or selling drugs in the workplace.

Differences between age groups were found for perceptions of coworker drug and alcohol use. In general, younger employees were more likely than older employees to report exposure to alcohol or drug use among coworkers. For example, 30 percent and 31 percent of 17 to 30 year olds and 31 to 40 year olds, respectively, reported coworker alcohol use--compared to 24 percent of those over 40 years. Likewise, 20 percent of 17 to 30 year olds indicated coworker marijuana use and 21 percent reported dealing among coworkers (versus 11 percent of the over 40 year age group reporting coworker marijuana use and dealing among coworkers).

Job classifications differed in their perceptions of marijuana use and dealing among coworkers, but not in perceptions of coworker alcohol or other drug use. The paraprofessional/service group was most likely to indicate marijuana use in their workgroup (24 percent), followed by skilled/technical (15 percent), and official/professional and clerical (7 percent and 5 percent, respectively). The same pattern was found for coworker dealing, with 21 percent of paraprofessional/service reporting dealing compared with 15 percent of skilled/technical and 11 percent of clerical and official/professional.

2. Attitudes Toward Policies

Employee attitudes were assessed toward policies they believed should be used by the city to protect employee safety in relation to alcohol or drug problems in the workplace. Table 3 shows that 68 percent of employees believed the city should conduct urine testing of new employees, 61 percent favored random drug testing of all employees, 91 percent wanted education programs for supervisors and employees, 85 percent favored improved working conditions to reduce drug and alcohol problems, 91 percent agreed there should be supervisor training to recognize and deal with drug and alcohol problems, and 92 percent would like to see an EAP established for assessment and referral.

Attitudes toward the more restrictive policies of urine testing of new hires and random urine testing of all employees differed according to age groups. The over-40 employees were more likely than their younger counterparts to favor testing of new employees (74 percent to 63 percent and 68 percent respectively) and random testing of all employees (71 percent to 52 percent and 60 percent). The vast majority of employees responded favorably to the other policies, and so there was little difference between age groups.

Table 3. Perceptions and Attitudes Toward Substance Use at Work by Age and Job Classification

	Age Group			Job Classification				
	17-30 Years	31-40 Years	41-70 Years	Offic/ Prof	Skill/ Tech	Clerical	Para/ Serv	TOTAL
				(percentages)				
PERCEPTION OF COWORKER USE:								
Alcohol Use	30	31	24	25	34	27	28	28
Marijuana Use	20	17	11	7	15	5	24	16
Other Drug Use	14	12	12	14	12	15	13	13
Dealing of Drugs	21	16	11	11	15	11	21	16
ATTITUDINAL SUPPORT FOR GENERAL POLICIES:								
Urine Testing of New Employees	63	68	74	51	75	69	74	68
Random Urine Testing	52	60	71	48	65	64	65	61
Drug Abuse Education	90	92	91	94	90	93	90	91
Improving Working Conditions	84	86	83	84	84	87	84	85
Supervisor Training To Handle Drug Problems	88	92	93	95	94	97	85	91
Establishing EAP	91	93	93	94	92	98	89	92
TOTAL PERCENTAGE OF GROUP								
Actual Number In Group	29	36	35	21	22	16	40	100
Total Number In Sample Size	271	343	329	191	198	146	360	943

Examination of attitude differences between job classifications showed that the official/professional group showed less support for urine testing policies than did the other three groups. Support for testing of new hires ranged from 75 percent of skilled/technical employees to 69 percent of clerical workers, compared to 51 percent of official/professional staff. Random testing of all employees was supported by less than half of the official/professional

staff (48 percent), compared to 64-65 percent for other groups. There were not large differences between groups in terms of support for other policies; however, clerical workers were more likely than paraprofessional/service employees to favor supervisor training (97 percent to 85 percent) and establishment of an EAP (98 percent to 89 percent).

DISCUSSION

The results presented above are preliminary data based on approximately one-half of the targeted sample for this project. Thus, although it is expected that the overall results are relatively stable, final judgement must await the full set of data and the more sophisticated analyses planned. However, several findings merit comment. These include participation rate, the overall prevalence rate for drug and alcohol use, the relationship between job classification and lifetime marijuana and other drug use, and the level of support found for urine testing as well as for other policies to deal with drug use at the worksite.

The project has been successful in obtaining a high volunteer rate for participation in the study. This has been achieved by careful planning of data security issues and high levels of cooperation with city officials and employee representatives. This level of cooperation has been observed at virtually all levels of management, down to workgroup supervisors who are ultimately responsible for notifying their employees and obtaining their cooperation. The high rate of supervisor support is highlighted by the fact that 84 out of 195 refusals (from 70 workgroups) came from only 4 workgroups (contributing only 33 completed questionnaires). Reports from the field staff indicated that the supervisors for these workgroups actively discouraged their subordinates from participating in the study.

The findings show, not surprisingly, that alcohol is by far the most common drug abused by the workforce. Overall, 77 percent of the workforce reported having used alcohol in the last year, with half admitting to having gotten drunk in the last year and over one-fourth at least once per month. These numbers appear consistent with those obtained in the 1988 NIDA Household Survey on Drugs showing 82 percent of 18 to 25 year olds and 69 percent of those 26 or older reporting alcohol use last year.

On the other hand, when compared to the 1988 Household Survey, prevalence of marijuana and other drug use in the current sample appears lower. The Household Survey showed about 28 percent of 18 to 25 year olds using marijuana in the last year and 7 percent of those 26 or older. The numbers presented above for the current survey for last year marijuana use were 15 percent, 6 percent, and 2 percent for the 17 to 30, 31 to 40, and 41 to 70 year age groups, respectively. These differences may suggest some under-reporting for the municipal sample, although they may also be

accounted for by sample differences. Further comparisons with more equivalent subsamples from the NIDA Household Survey would shed more light on this issue.

Cross-tabulations of drug prevalence rates by age and job classification showed that younger age groups were more likely to use drugs than older age groups. This finding was expected and is consistent with the NIDA Household Surveys conducted over the years. However, the relationship between job classification and drug use was not expected. Higher level job classifications (official/professional) were more likely to report lifetime marijuana and other drug use than were lower job classifications, but this relationship appeared to be partially explained by differences in race and education between job classifications.

Also unanticipated was the relatively strong support for employee urine testing. Overall, 68 percent of respondents favored the use of pre-employment testing and 61 percent favored random testing of all employees. This was much higher than expected for these policies and was related to both age and job classification; older employees and lower level job classifications showed the highest levels of support. These same groups reported less personal drug use but higher levels of coworker drug use.

CONCLUSION

The preliminary results of this study suggest that with careful attention to data security issues and gaining employee trust, a self-report drug use survey within an employee's own organization can be successfully implemented. Feedback from employees completing the questionnaire has indicated that the majority describe their participation as interesting and useful. In fact, the biggest concern expressed by most respondents has been their interest in getting feedback on findings from the study.

The findings on employee drug use and policy recommendations are interesting but need to be confirmed and explored further with more complete samples. Additional objectives of the current project include detailed work environment and job characteristics related to drug use, the effect of job satisfaction and job tension on drug use, and the impact of drug use on a variety of job productivity measures, (including physical and psychological withdrawal behaviors). These objectives are well-suited for the methodology employed and provide information not easily obtained from other data collection models described earlier (e.g., household surveys, urine screen results, and EAP referrals). It appears that the approach being used in this self-report study is very promising in terms of feasibility and overall quality of data. Because of the competing strengths and weaknesses of each one, however, all four models (including the self-report model used here) are

needed to provide as complete a picture as possible to accomplish the difficult task of describing and explaining drug use in the workplace.

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Drug Use Trends in a Nuclear Power Facility: Data From A Random Screening Program

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This is the second article describing the results of the ongoing substance screening program at Southern California Edison's San Onofre Nuclear Generating Station (SONGS). The first (Osborn and Sokolov, 1989) detailed the evolution of substance screening via non-random urinalysis over a four year period from 1984 through 1988. The present paper describes the rationale and structure of the latest "Two Strike, Random Model" program and its results after one year of operation.

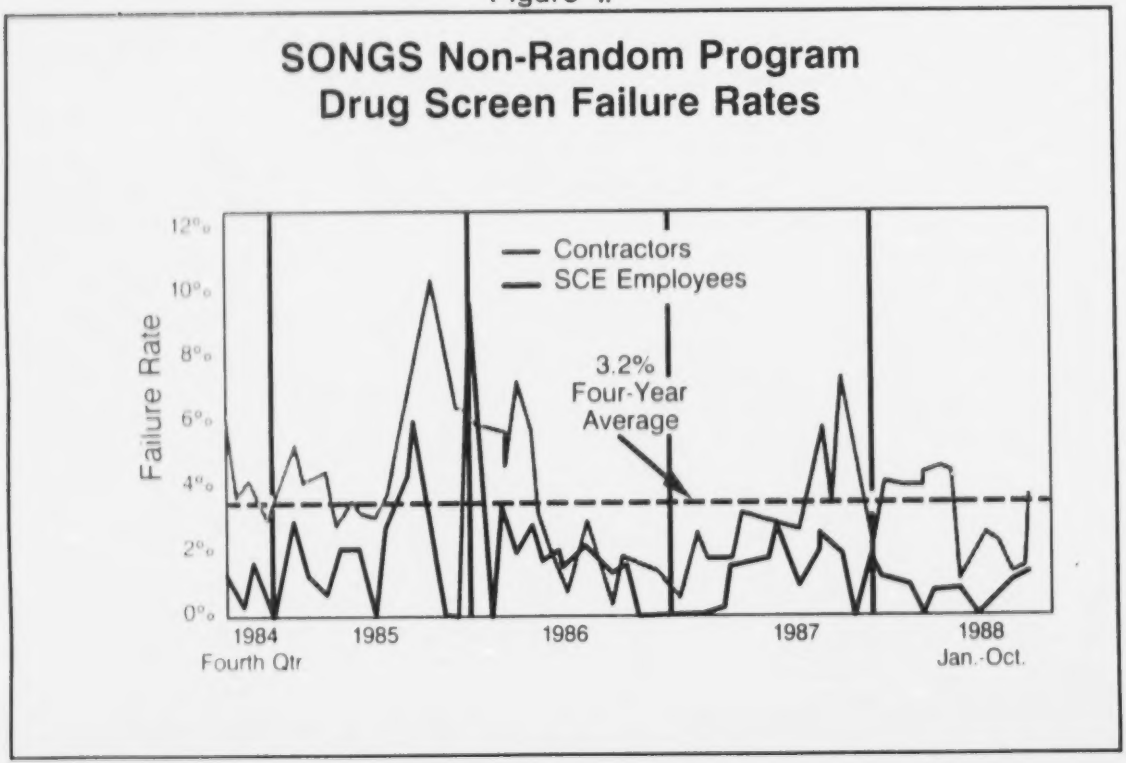
The Rationale for the Random Screening Program

The Two Strike, Random Model substance screening program was created for many reasons, some theoretical, some practical. Although legal and regulatory mandates specifying the creation of such programs provide basic structural guidelines, substantial latitude remains concerning their rationale and form.

Unacceptable Failure Rates

The primary motivation for the development of a random substance screening program at San Onofre was the simple fact that the overall failure rate under various non-random programs was too high, averaging about 3.2% (figure 1). Safety concerns and public confidence issues demand higher standards of behavior from nuclear workers.

Figure 1.


SONGS Non-Random Program
Drug Screen Failure Rates
Failure Rate
12%
10%
8%
6%
4%
2%
0%
Contractors
SCE Employees
3.2%
Four-Year
Average
1984
Fourth Qtr
1985
1986
1987
1988
Jan.-Oct.

Under the previous three non-random programs (figure 2), the average worker with Unescorted Access Authorization (a Red Badge) was screened only once a year, at the time of badge renewal (Osborn and Sokolov, 1989). In effect, this provided a full year's notice of the date of each worker's next substance screen. While a few workers were screened more frequently, some on an unannounced schedule, they first had to fail a routine screen or behave in such a way as to create a reasonable suspicion of substance use. Generally, only personnel who were either too unsophisticated or too dependent to curtail their substance use prior to their scheduled screens were detected.

Figure 2.

The Historical Evolution of SONGS Substance Screening Program

September 1984 to May 1985:	Idiographic Program
May 1985 to December 1986:	Four-Strike Program
December 1986 to November 1988:	Three-Strike Program
November 1988 to Present:	Two-Strike, Random Model Program

Changing Social Values

Another factor promoting change in the substance screening program at SONGS was a dramatic shift in social values. Southern California Edison first began commercial operations at San Onofre in 1968, when public attitudes toward drug use were considerably different, particularly in Southern California. Present trends toward the use of highly addictive stimulants has substantially altered the social image of the drug user. With the extraordinary addictive potential of these substances, the stereotype has changed from the "experimenting college student" dabbling on weekends, to the "desperate addict" willing to risk everything to abuse these drugs.

The highly addictive and dangerous properties of these new drugs underlie a rationale introduced to support substance screening for nuclear workers. The Nuclear Regulatory Commission, in its Fitness For Duty Rule, posits a "trustworthiness and reliability" doctrine (10 CFR 2 & 26). This rationale

rests on the logic that anyone willing to break the law by using an illegal substance is too untrustworthy and/or unreliable to be granted unescorted access to a nuclear facility. While such a position can be stretched to cover any illegal substance, much of its persuasiveness derives from its application to highly addictive and dangerous substances.

Changing Science

Another factor molding present policy is the scientific state of drug screening technology. As of this writing, impairment at any particular moment in time is exceedingly difficult to demonstrate, except in the most extreme cases. Over the past decade, however, valid and reliable methods of measuring substances/metabolites have evolved to the point that large scale screening is practical and accurate. But because these techniques only confirm substance use, not what effects it had, or is having, it must be somehow established that even the ingestion of the substance is worthy of action. Hence, a combination of the "trustworthiness and reliability" doctrine with the realities of present screening technology provides a basis to act upon the new social values regarding substance use.

These factors combine to produce a political, legal and pragmatic imperative - screen for drugs. But this rationale only dictates the creation of a substance screening program, not its structure.

The Structure of the Random Screening Program

Operationalizing the random screening program at SONGS required answers to a series of interrelated questions. Each such question had several alternate solutions, one influencing the other. Nevertheless, choices were made, some based on hard fact, some on best guesses. The primary questions were those common to all substance screening programs: Who should be screened? When should screening occur? What should ensue from a positive screen?

Screening Subjects

Exactly who should be screened at SONGS was recently defined by the NRC. "The provisions of the fitness-for-duty program must apply to all persons granted unescorted access to protected areas, and to licensee, vendor, or contractor personnel required to physically report to a licensee's Technical Support Center (TSC) or Emergency Operations Facility (EOF) in accordance with licensee emergency plans and procedures." (10 CFR 26, Section 26.2, pp. 24495)

Similar rules mandate screening specified workers regulated by the Departments of Transportation and Defense. On a broader basis, though, there has been some difficulty defining the proper substance screening subject population. With the flurry of legal activity surrounding the issue, trend spotting is hazardous at best, but it presently seems that personnel performing "safety or security sensitive" work are evolving as the class most clearly subject to substance screening, particularly through random selection. There is little doubt that nuclear workers fall in this category.

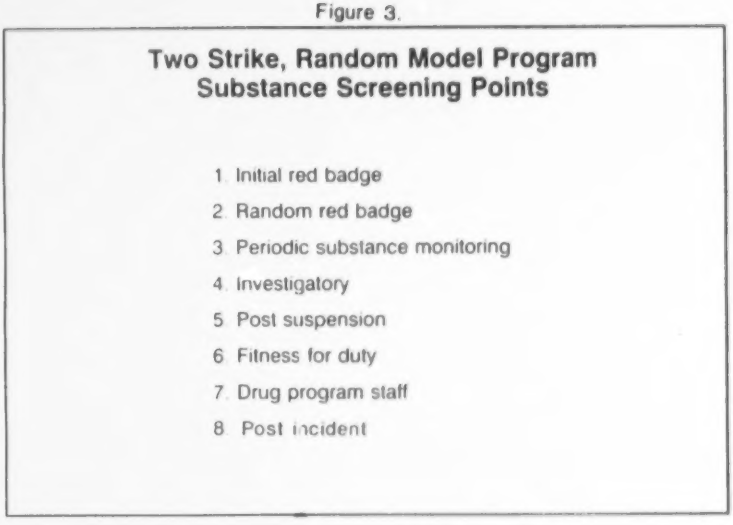
Screening Points

Decisions about when to screen necessarily incorporate judgments about two important constructs - detection and deterrence. While detection might initially seem to be a concrete fact rather than an abstract construct, such is not the case. For while the science of toxicology can be quite precise, it is, and will remain, a human judgement when to label a drug screen result "positive". Recognition of this issue is implicit in the creation of both substance metabolite cutoff points and the Medical Review Officer (MRO) in recent federal rule making (e.g., 10 CFR 2 & 26, 49 CFR 391 & 394). While cutoff points can be structured according to a dispassionate measurement of technical factors such as sensitivity, base rates and interreactivity, the idea that an experienced physician must be the final arbiter of detection is an irrefutable acknowledgement of its true nature.

The abstract status of deterrence is more clearly apparent. While its influence can be measured indirectly by several means, such as detection rates and subjects' self reports, it is impossible to assess directly. Ultimately, the only thing certain is that corporate managers and regulatory agencies generally agree that maximization of deterrence is a desirable goal.

Initially, Southern California Edison sought to increase the deterrence of its substance screening program at SONGS in several ways. One method was the introduction of unannounced testing in 1986. Organized labor quickly obtained an injunction preventing unannounced testing however, which remained in effect until November, 1988. Upon its dissolution, the Two Strike, Random Model program was initiated at SONGS, utilizing the screening points listed in figure 3. Each point has different aspects that argued for its inclusion: some are highly deterrent in nature, particularly the random and periodic substance monitoring tests, while others are largely protective or punitive, such as pre-employment and fitness for duty tests. These screening points were chosen to maximize both detection and deterrence, and thus promote the overall goal of a drug free workplace.

Figure 3.



Response to Failures

Once screening points are chosen, decisions must be made about the contingencies associated with failure. Interestingly, some aspects of a much broader debate are reflected in these contingency choices. That debate has been characterized as the "disease model" versus the "willpower model" of substance abuse. While the medical professions have made recent gains in their efforts to portray substance abuse as a disease entity, there remains a strong tendency to see substance abuse as a personal failure, characterized by a lack or failure of willpower. To the extent that substance abuse is attributed to a failure of willpower, moral judgments about the individual's behavior naturally follow. Therefore, if a person is involved in abuse, discipline seems appropriate.

Presently, a mix of the disease and willpower models predominates in most corporate substance abuse programs. Depending on professional associations and personal predilections, individuals charged with determining substance screening failure contingencies typically include aspects of each. In nuclear generating facilities like SONGS, this is formally mandated by the Nuclear

Regulatory Commission. The disease model is supported by requiring treatment through the licensee's Employee Assistance Program. The willpower model is reflected by the disciplinary action of a Red Badge suspension of at least 14 days. In addition, "Nothing herein shall prohibit the licensee from taking more stringent action." (10 CFR 26, p. 24498). The SONGS Two Strike, Random Model program, therefore, incorporates a two week suspension and a one year mandatory treatment program.

The rationale and structure of the program at SONGS evolved from careful consideration of these various issues. The forgoing discussion provides a background to interpret the results of the Two Strike, Random Model program after one year of operation. The remainder of this paper will focus on an analysis of these results.

Results

Analysis of Failures by Personnel

Between November, 1988 and November, 1989, SONGS personnel with Unescorted Access, a Red Badge, failed 114 substance screens at San Onofre. This represents all failures at all screening points (see figure 3). A substantial initial drop following implementation was followed by considerable month-to-month variability.

The absolute number of screening failures is, of course, related to the absolute number of screens. In turn, the absolute number of screens performed during any period is a function of both the screening rate and the number of Red Badges valid during that period. It is the nature of nuclear power generation to cycle through periods when large numbers of personnel are needed to assist with refueling and maintenance needs. This introduces wide variability in the number of Red Badged personnel, particularly in a multi-reactor facility like SONGS.

Perhaps the clearest way of expressing the overall relationship is through the failure rate, or the percentage of test failures occurring during each time period (figure 4).

Interesting trends become evident when failure rates are compared for the two major classes of workers at SONGS, employees and contract personnel. Parallel plots show the recent emergence of contrasting patterns (figure 5).

Figure 4.

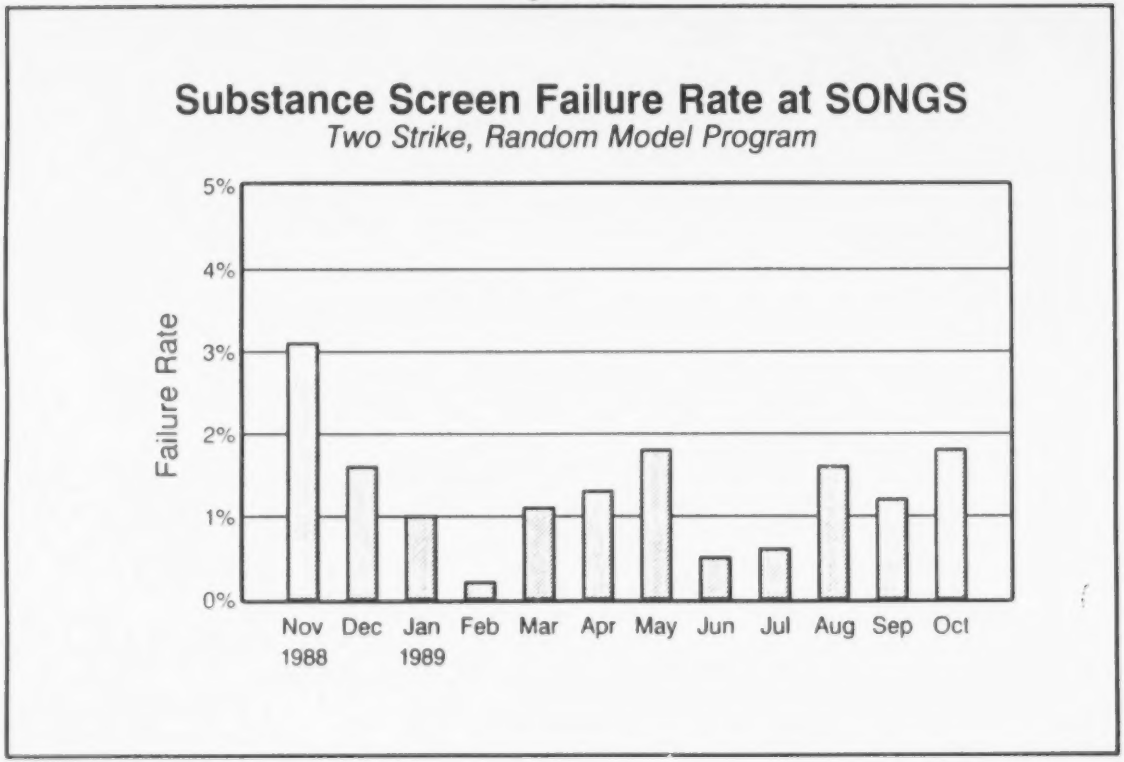
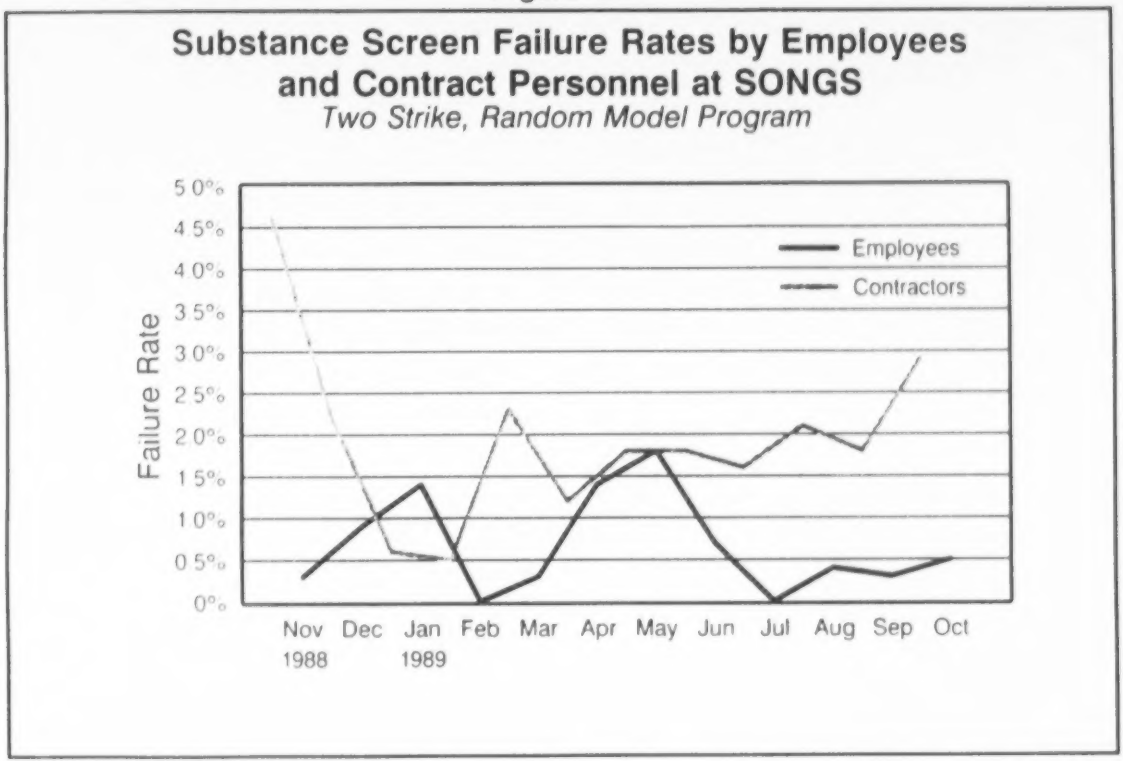

Substance Screen Failure Rate at SONGS
Two Strike, Random Model Program
Failure Rate
5%
4%
3%
2%
1%
0%
Nov 1988
Dec
Jan 1989
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

Figure 5.


Substance Screen Failure Rates by Employees and Contract Personnel at SONGS
Two Strike, Random Model Program
Failure Rate
5.0%
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0%
Employees
Contractors
Nov 1988
Dec
Jan 1989
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

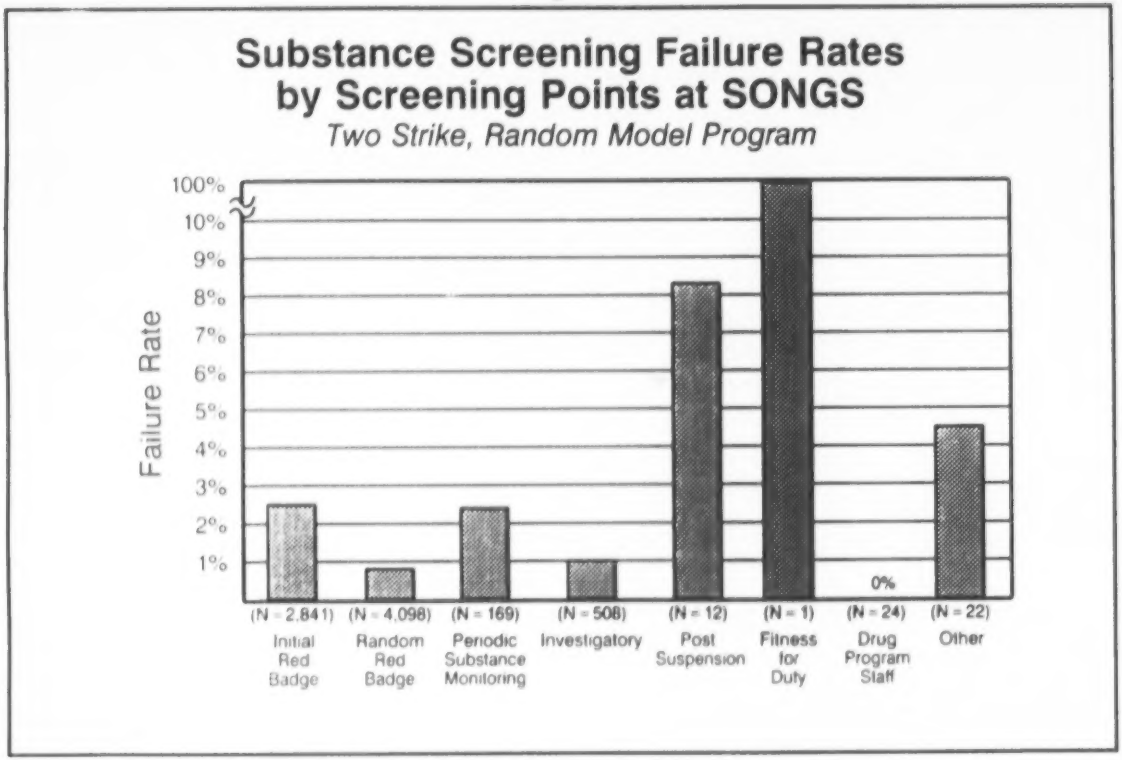
After an initial period of "testing" the program, overall failures dropped off in the summer of 1989. The failure rate for contract personnel rose again but the employee rate remained low. There are several possible explanations. Perhaps some employees involved in substance abuse simply quit abusing, either out of concern for being caught or, for some, because they actually were caught. Still others probably made a conscious choice to continue substance use, transferred out of the Protected Area and retired their Red Badges, thus avoiding detection. Contractors, on the other hand, continue to show wide variability.

Given some thought, this divergence between employees and contract personnel might be expected. The "Two Strike" portion of the SONGS program is, by necessity, operationalized differently for employees and contractors. If contract personnel fail a substance screen at any time they hold a Red Badge, their Badge is immediately lifted and they are denied reapplication for eight weeks. Effectively, most lose their assignment at SONGS since the duration of contract work is generally brief. While they are encouraged to participate in treatment, most do not. Contract personnel may reapply for a Red Badge after eight weeks have elapsed, through a process of rigorous multidisciplinary assessment, but if they fail a second time, the consequences are even more severe.

Unfortunately, a realistic analysis of the common outcomes of substance screen failures shows that even though SONGS management maintains a very strict policy, contract personnel failing a screen have less to lose than employees. Often contract personnel work for firms that simply reassign them to another work site. Although employment at SONGS is relatively desirable, skilled personnel can usually find other work in an economy as broad as Southern California's. Instead of facing a two-week suspension without pay, a blemish on their work record and a year-long mandatory treatment program, contract employees are often working at another site the same day. Clearly, the deterrence is less.

Another way of looking at these data is through an analysis of screening failure rates by screening points (figure 6 - Note the small sample size in some categories). It is particularly interesting that there is little difference between the failure rates for Random and Investigatory screens, since the latter are performed only "for cause". This may be an artifact of a highly inclusive subject selection process used during investigatory screening. For example, when a drug find occurs in a limited access area of the plant, all personnel using that area during a particular time period are often screened. This obviously includes a fair number of people who produce negative screens. While resulting in a modest "hit" rate, this approach does have a strong deterrent effect, even when the results are negative, through a heightened awareness of screening efforts.

Figure 6.


Substance Screening Failure Rates
by Screening Points at SONGS
Two Strike, Random Model Program
Failure Rate
100%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
(N = 2,841)
(N = 4,098)
(N = 169)
(N = 508)
(N = 12)
(N = 1)
(N = 24)
(N = 22)
Initial Red Badge
Random Red Badge
Periodic Substance Monitoring
Investigatory
Post Suspension
Fitness for Duty
Drug Program Staff
Other

Finally, although the "Two Strike, Random Model" program departs from previous programs in several ways, the most marked change is the inclusion of a random screening point. Figure 7 shows the trend of random screening failure rates for employees and contract personnel.

In sum, several conclusions can be drawn. First, the substance screen failure rate dropped at SONGS after the implementation of the "Two Strike, Random Model" program, from over three percent to less than one percent. Second, that effect is more marked among employees than contract personnel. This is probably due to the different consequences of failure. Finally, these substance screening program changes created a natural experiment of sorts. Unfortunately, this in vivo experiment lacks a control group and contains several confounds: multiple variables changed simultaneously with the introduction of the "Two Strike, Random Model" program. But with these caveats in mind, the most logical attribution of cause for the marked drop in failure rates would seem to be an increase in deterrence, due largely to the twin effects of random screening and the negative consequences of screen failure.

Analysis of Substances Detected

The actual substances detected through the Two Strike, Random Model follows trends evident in previous programs at SONGS (Osborn & Sokolov, 1989). Figure 8 shows a breakdown of screen failures by substance. In general, the proportion of 60% stimulants and 40% marijuana is in line with local trends over the past several years. For awhile now, the illegal drug market in Southern California has offered inexpensive methamphetamine in addition to the various forms of cocaine, producing an elevated amphetamine failure rate at SONGS. This may be aggravated by the fact that many personnel at SONGS work rotating shifts. The effects of such shifts on worker fatigue are well known, and a connection might exist between stimulant abuse and shift-structure induced fatigue. Efforts are underway to investigate this possibility.

Figure 7.

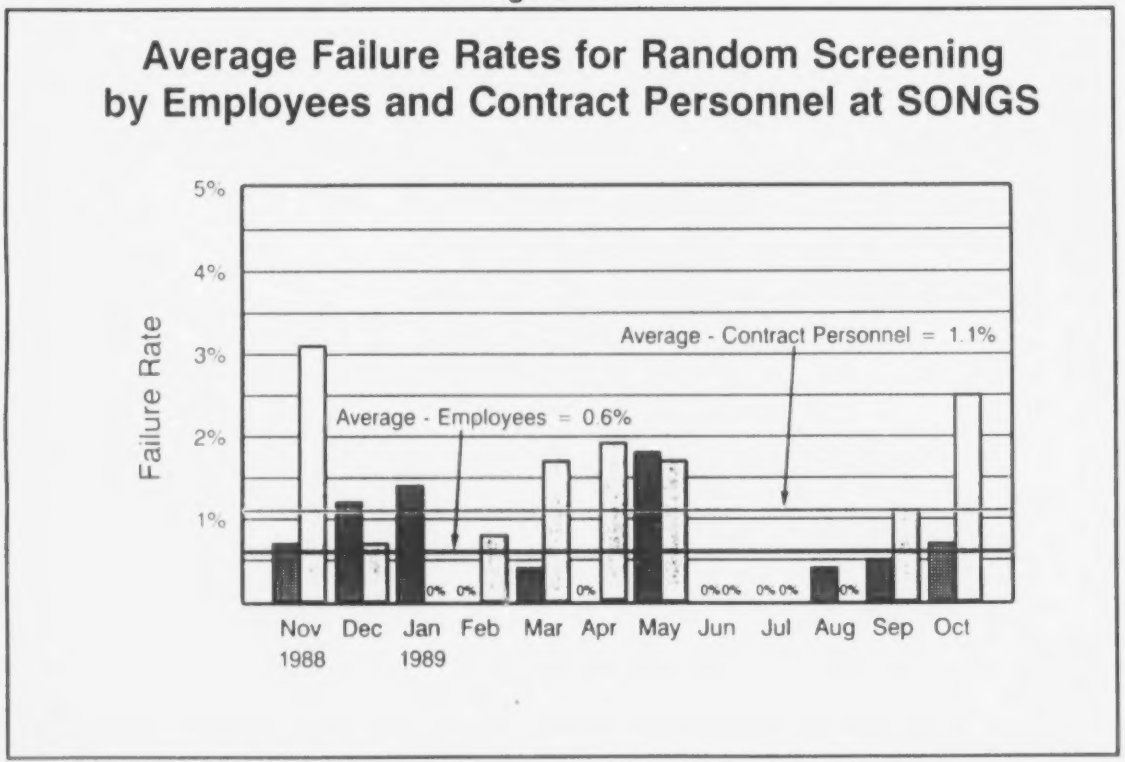
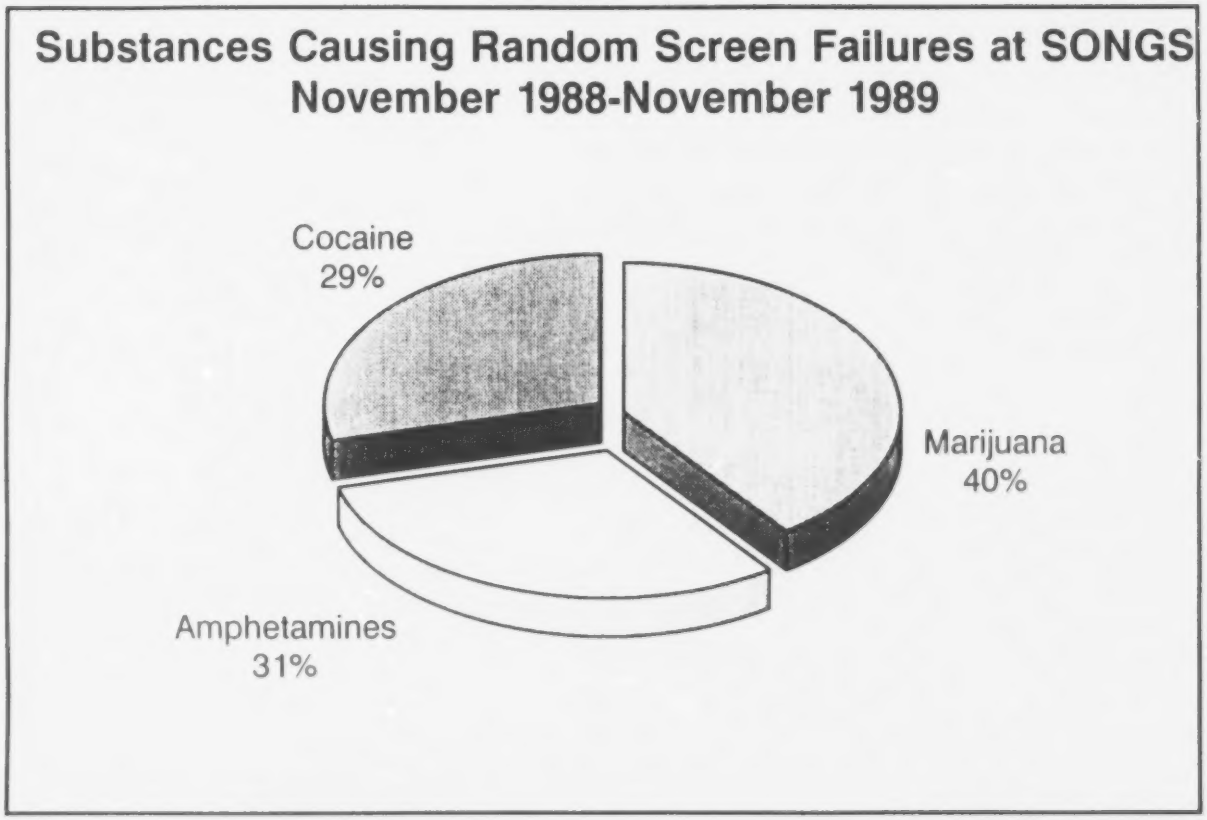

Average Failure Rates for Random Screening
by Employees and Contract Personnel at SONGS
Failure Rate
5%
4%
3%
2%
1%
Average - Contract Personnel = 1.1%
Average - Employees = 0.6%
0% 0% 0% 0% 0% 0% 0% 0%
Nov 1988
Dec
Jan 1989
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

Figure 8.


Substances Causing Random Screen Failures at SONGS
November 1988-November 1989
Cocaine
29%
Marijuana
40%
Amphetamines
31%

Summary

This paper has detailed the creation, implementation and results of the new Two Strike, Random Model substance screening program at Southern California Edison's San Onofre Nuclear Generating Station. This program, the fourth in an evolutionary process beginning in 1984, shows good results after one year of operation. Although not without its difficulties, the reduction in substance screen failure rates achieved thus far provides incentive to continue the quest for a truly drug free workplace.

REFERENCES

Osborn, C.E. & Sokolov, J.J. Drug use trends in a nuclear power company: Cumulative data from an ongoing testing program. In S.W. Gust and J.M. Walsh, eds., *Drugs in the Workplace: Research and Evaluation Data* (pp. 69-80). Rockville, MD: National Institute on Drug Abuse, DHHS Publication No. (ADM)89-1612, 1989.

49 CFR 391 & 394. Federal Register, Vol. 53, No. 224, Monday, November 21, 1988.

10 CFR 2 & 26. Federal Register, Vol. 54, No. 108, Wednesday, June 7, 1989.

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Mandatory Post-Accident Drug and Alcohol Testing for the Federal Railroad Administration: A Comparison of Results for Two Consecutive Years

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INTRODUCTION

The railroads have long been concerned with on-the-job substance use. About the time the transcontinental rail system was completed, in the 1860s, Rule G was instituted prohibiting on-job use, possession of, or impairment by alcohol. Implementation and reparation of the Rule was under the authority of individual railroads. Despite the existence of Rule G, substantial evidence existed that alcohol was consumed on duty by railroad employees. A joint railroad-labor-Federal Railroad Administration (FRA) sponsored survey (Mannello, 1979) in 1978 found:

- 23% of railroad operating employees were problem drinkers.
- 5% of workers reported to work "very" inebriated or got intoxicated on duty at least once during the study year.
- 13% reported to work at least slightly intoxicated on one or more times during the study year.
- 13% of operating employees drank on duty at least once during the study year.

During the last two decades there has been growing concern not only about alcohol, but also about drug use in the transportation industry. From 1975 to 1984, the FRA used autopsy findings to document that 48 accidents resulting in 37 fatalities, 80 injuries, and $34 million in property damage were caused by alcohol and drug impaired employees (FRA, 1985). In 1983, the FRA initiated the rulemaking process to address alcohol and drug safety concerns. This process resulted in formulation of the final Federal Rule (49 CFR) which covered "The control of alcohol and drug use in railroad operations" (FRA, 1985). The final rule considered several issues including:

- Federal Prohibition of Alcohol and Drug Use
- Post-Accident Toxicological Testing
- Authorization to Test for Reasonable Cause
- Identification and Assistance of Troubled Employees
- Pre-employment Drug Screening
- Improved Accident Reporting

While several aspects of the resulting rule were under direct control of the railroads, post-accident drug and alcohol testing was to be performed under the direct supervision of the FRA. Mandatory post-accident toxicological testing, initiated in February, 1986, was a major aspect of the rule. In April, 1987, the analytical testing was transferred to the Center for Human Toxicology (CHT). A prior report described the program, and presented the results from the first year of analyses at our facility (Moody, et al., in press). We have now compiled the results from the first two years of analysis, allowing for a comparison between these two years.

CRITERIA FOR TESTING

Railroads are required to report all accidents exceeding specified damage thresholds, and incidents resulting in reportable injuries to railroad employees. Collectively these are referred to as events. The following define reportable events (FRA, 1987):

- **Train Accidents:** "A collision, derailment, or other event involving the operation of railroad on-track equipment resulting in damages which exceed the reporting threshold." ($5,200 for 1987)

- **Impact Accident:** "A head-on, rear-end, side, or switching collision between rolling railroad stock, or impact of rolling stock with a deliberately placed obstruction, which does not include impact which follows derailment, or impact with fallen natural objects, such as trees, rocks, or snow."

- **Train Incidents:** "Any event involving the movement of railroad on-track equipment that results in death, a reportable injury, or a reportable illness, but in which railroad property damage does not exceed the reporting threshold."

- **Reportable Injury:** "Physical harm which requires treatment beyond first aid, causes at least one day of absenteeism from work, or results in restriction of employees work performance."

Not all reportable accidents and incidents are subject to mandatory post-accident testing. Those qualifying for testing are presented in table 1.

Table 1. Criteria Which Must be Met for Railroad Accidents and Incidents to Qualify for Mandatory Post-Accident Testing.

Classification	Abbreviation
Major Train Accidents With:	
A) A Fatality	TA / FAT
B) Damage in Excess of $500,000	TA / 500K
C) Hazardous Material Release resulting in: Evacuation, or Reportable Injury	TA / HMR
Impact Accidents With:	
D) A Reportable Injury	IMP / INJ
E) Damage in Excess of $50,000	IMP / DAM
Train Incidents With:	
F) A Fatality	TI / FAT

The rationale for selection of the test-initiating criteria are more fully discussed in the proceedings of the rulemaking process (FRA, 1985). In summary, the 3 categories of accidents and incidents shown in table 1 were chosen for mandatory post-accident testing based on:

1) prior experience, which suggested that the causal determination of major train accidents is complex, often involving two or more contributing factors, 2) indication that a large percentage of impact accidents were caused by human performance factors, and 3) it is rare that the cause of deaths in fatal train incidents is fully understood. Fatalities involving non-employees or employees not on duty were exempted from testing because previous investigations suggested that few, if any of these arose from employee negligence. Railroad highway grade crossings accidents are also exempted from testing, as the FRA felt that in most cases the railroad employees could only be viewed as additional victims in these tragedies, and that the railroads would have the discretion to conduct their own testing in any instance where there is reasonable suspicion of employee involvement.

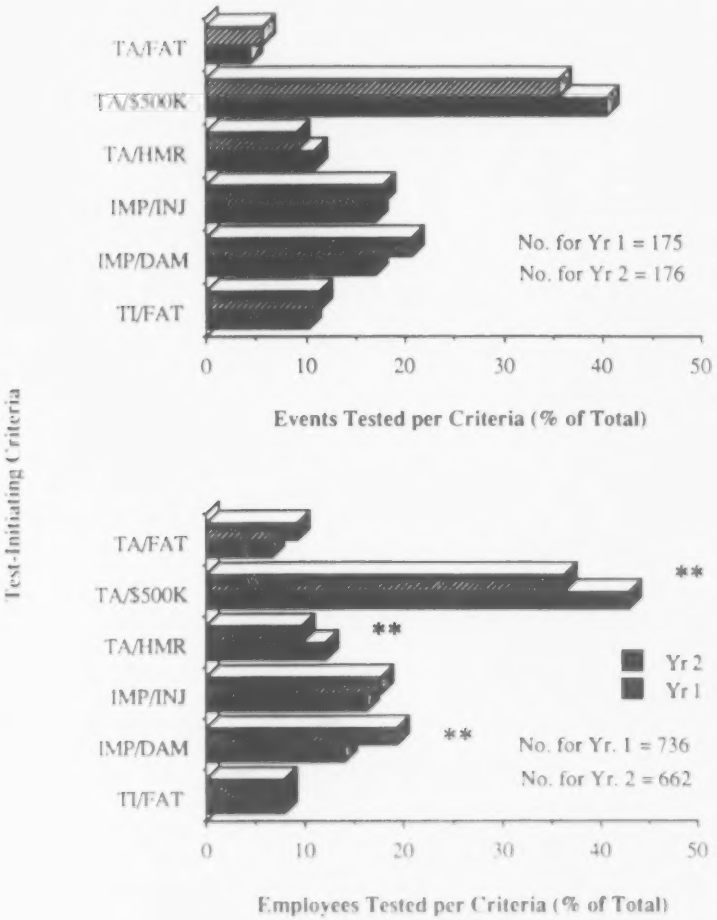
Railroad officials must make an initial decision concerning whether an event qualifies for testing based on a "good-faith" estimate of damages and injuries incurred. For major train accidents, all train crew members must be tested. Operators, dispatchers, signal maintainers, or other employees covered by the Hours of Service Act will also be tested, if they are determined to be involved in the circumstances of the event. In impact accidents or fatal incidents, covered employees whom the railroad immediately determines had no role in the cause of the accident or incident may be excluded from testing. The proportion of events within any one test-initiating criteria, and their change from one year to the next provides insight into the magnitude of major train accidents occurring on the Nation's railroads.

EVENTS AND EMPLOYEES QUALIFYING FOR TESTING

The total number of events qualifying for mandatory testing, and the total number of employees tested for years one and two are shown in table 2, with the number per test-initiating criteria presented in figure 1. Approximately 50% of the qualifying events were non-fatal major train accidents, with impact accidents and fatal events comprising approximately 30 and 20% of the total, respectively.

There were a similar number of qualifying events in both years, but the number of fatal events and the total number of employees tested declined in year two. As shown in figure 1, there were only modest changes in the proportion of events arising from a specific test-initiating criteria. Slight increases in the proportion of major train accidents with damage or hazardous material release were coupled with slight decreases in the proportion of the impact and fatal events. The number of employees tested under a specific criteria were, however, significantly increased in major train accidents with damage or hazardous material release, and significantly decreased in impact accidents with damage. Further, more employees were tested for certain events than for others, as shown in table 3.

Figure 1. Events and Employees Qualifying for Testing



** - The proportion in year one is significantly different from the proportion in year two ($p<0.05$).

Within any one study period (e.g. 1, 2, or 1 & 2 years), there was a consistency in the ranking of the number of employees tested per event based on the test initiating criteria. Fatal train incidents and impact accidents had fewer employees tested per event, reflecting, in part, the discretion railroad officials may use in deciding which crew members will be tested. No such discretion is allowed with the major train accidents. Further, most major train accidents with fatalities involve collisions between two trains, increasing the number of crew members subject to testing per event. Indeed, the number of employees tested per major train accident with a fatality was significantly greater than the other criteria, in all three study periods. Depending upon the study period, there may have been no other significant differences (Year 1), or an overlap of some categories (Year 2 and Years 1 & 2). There were modest changes from Year 1 to 2 in the number of employees tested per event (table 3). While there was a slight decrease in this ratio for all test-initiating criteria, only the decrease in number tested per impact accidents with damage was statistically significant. This decrease may have arisen in part, from railroad officials becoming more proficient in using their discretionary power in deciding which employees must be tested.

Table 2. Number of Events and Employees Qualifying for Mandatory Post-Accident Drug and Alcohol Testing

	Year 1	Year 2
Qualifying Events		
Non-Fatal Events	145	150
Fatal Events	30	26
Total	175	176
Employees Tested		
Non-Fatalities	700	635
Fatalities	36	27
Total	736	662

Chi-square analysis of the proportion of fatal events and fatalities revealed that there were no significant differences ($p<0.05$) between years 1 and 2.

Table 3. Employees Tested Per Qualifying Event

Test-Initiating Criteria	Employee / Event Year 1	2	1&2
TI / FAT	2.90 ± 0.35[a]	2.89 ± 0.64[a]	2.89 ± 0.35[a]
IMP / DAM	3.94 ± 0.34[a]	3.07 ± 0.25[a*]	3.55 ± 0.23[a,b]
IMP / INJ	4.19 ± 0.47[a]	3.60 ± 0.37[a,b]	3.90 ± 0.30[a,b]
TA / $500K	4.31 ± 0.21[a]	4.03 ± 0.17[a,b]	4.16 ± 0.13[b]
TA / HMR	4.44 ± 0.43[a]	4.21 ± 0.29[a,b]	4.31 ± 0.25[b]
TA / FAT	6.80 ± 0.71[b]	5.50 ± 1.16[b]	6.22 ± 0.65[c]

Note: Values are presented as the Mean ± SE.
* - Significant difference between years for a specific test-initiating criteria ($p<0.05$)
a,b,c, - One-Way ANOVA analysis of data in rows initially demonstrated a significant difference among the values ($p<0.05$). Specific differences between employees tested / event were then determined by the Tukey Test. Those which do not share the same letter in the footnote are significantly different ($p<0.05$).

SPECIMEN RECEIPT

Under the FRA's testing regulations, employees must submit both a blood and urine specimen for drug and alcohol testing following qualifying events. Specimen collection following a fatality was dependent on the conditions of the corpse. As can be seen in table 4, there was excellent compliance with the rule, with only 1% of the employees either refusing to provide, or not cognizant of the specimen requirement. In fatalities both blood and urine were obtained in a majority of the cases, but some analyses were performed on vitreous humour or tissue due to specimen constraints.

Collection of specimens is performed as soon as possible, but not in lieu of attendance to emergency situations. Specimens collected at medical facilities distant from the remote sites of the qualifying event do not lend themselves to efficient collection of forensic specimens. Records from the first year (Moody, et al., in press) documented that the delay between the time of the event and the collection of specimens ranged from 1.25 to 12.75 hrs, with an average of 5.36 hr. Further, the average time to specimen collection varied with the test-initiating criteria from an average of 4.76 hrs for impact accidents with injury to 5.79 hrs for major train accidents with damage. While less than optimal for the evaluation of toxicological results, it is an inherent difficulty of testing on the rail system.

Table 4. Specimens Received for Testing

	Year 1	Year 2
Non-Fatalities: Total	700	635
Blood + Urine	688	629
Urine Only	9	6
Blood Only	3	0
Fatalities: Total	36	27
Blood and Urine/Vitreous	20	14
Blood ± Tissue	13	8
Tissue ± Vitreous	2	0
Tissue Only	1	5

ANALYTICAL PROTOCOL

Specimens received for toxicological testing were subjected to 3 levels of analysis; 1) a test for urine integrity, 2) initial tests of urine for drugs and blood for alcohol, and 3) confirmation and quantitative analysis of both blood and urine if indicated (Moody, et al., in press). To evaluate urine integrity, the pH and specific gravity were determined. If the specific gravity was $\leq$ 1.005, the creatinine content of the urine was also determined. Urine specimens with a specific gravity $\leq$ 1.005 and creatinine $\leq$ 6.0 mg/dl, or with a pH $<$ 4.0 or $>$ 8.0 were subjected to more stringent screening and reporting cutoffs. This contingency was required in only a few instances during the two-year period, and only to allow reporting of urine concentrations of analyte(s) which were present if reportable blood levels were found.

Urine specimens were analyzed by immunoassay for eight drug groups, the benzodiazepines were determined by enzyme mediated immunotechnique (EMIT) and all other drugs by radioimmunoassay (RIA) using Abuscreen reagents. RIA was also used when it was necessary to perform the preliminary analysis on blood or tissue homogenates. Gas chromatography (GC) / electron capture detection (ECD) was used to screen the blood and tissue for benzodiazepines if urine was unavailable. Preliminary analysis for ethanol was performed on blood, (or urine or tissue homogenate if blood was not available), by GC / flame ionization detection (FID). If any of the preliminary analyses revealed the presumptive presence of a drug group at

or above the cutoff concentration (table 5), the blood and urine, or tissue specimens were submitted for confirmational and quantitative analyses.

All confirmations of drugs and drug metabolites were performed by GC / mass spectrometry (MS) (Foltz et al, 1980; Crouch et al, 1983). For most drugs, the confirmation and quantitation was performed simultaneously using GC / chemical ionization (CI) MS with deuterium labeled internal standards. The barbiturates were quantitated by high pressure liquid chromatography (HPLC), and confirmed by GC / electron impact (EI) MS. All the benzodiazepines, except chlordiazepoxide, were quantitated by GC / ECD. Chlordiazepoxide and metabolites were quantitated by HPLC, and confirmed by GC / EIMS. Ethanol was confirmed by GC / FID utilizing a second column with a different packing material. Positive findings were reported if any drugs or metabolites were confirmed, and quantitated at or above the confirmatory cutoffs (table 5). Reports were released only after analysis was completed for all the employees tested in regard to a single qualifying event.

Table 5. Administrative Thresholds (Cutoffs): FRA vs IIHS

	Screening		Confirmation		
Drug Groups	FRA Urine	IIHS Urine	FRA Urine	FRA Blood	IIHS Urine
	(ng/ml)				
Cannabinoids (Carboxy)	20	100	20	2	15
(THC)	---	---	---	1	---
Cocaine Metabolite (BE)	300	300	150	50	150
(Cocaine)	---	---	50	50	---
Opiates	300	300	100	100	300
Phencyclidine	25	25	25	25	25
Amphetamines	300	1000	100	100	500
Barbiturates	200	***	200	200	***
Benzodizepines	300	***	300	300	***
Methaqualone	750	***	500	500	***
Ethanol (mg %)	10	***	10	10	***

ANALYTICAL FINDINGS

A positive report could involve a single employee with a single substance, or multiple employees with one or more substances. Positive test results are summarized in table 6 by number of drug or alcohol positive events, number of positive employees, and number of substances detected. Not all positive specimens resulted in positive reports, since in a few instances, medication, or alcohol ingestion occurred post-accident. Also, in some fatalities, low

levels of ethanol were detected which were consistent with post-mortem generation of ethanol. These findings are not presented in this report. Some positive findings were consistent with the employee's statement of medication pre-accident and these are considered in the total positive findings, but not as illicit positives (table 6).

As demonstrated in table 6, there were incidents where more than one employee tested positive in a single event. In the first year, there were 5 events with 2 positive employees and 1 event with 3 positive employees. In the second year, there were also 5 events with 2 positive employees and 1 event with 5 employees testing positive for drugs. Further, there were 3 employees who tested positive for multiple substances in the first year (2 for 2 drugs and 1 for 3 drugs), and there were 4 employees who tested positive for multiple drugs (2 each) in the second year. Four and 2 of the positive substances detected during the first and second years, respectively, were prescribed medication. There was a modest decrease in the number and percentage of positive events, employees and substances detected from year 1 to year 2. This decrease, however, was only statistically significant for the proportion of total positive events.

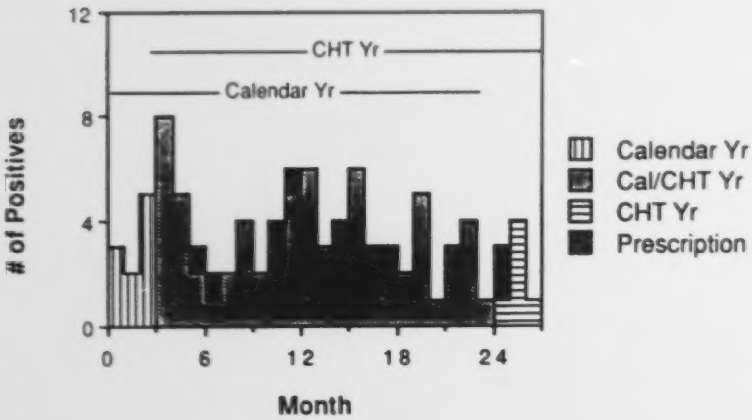
Table 6. Summary of Positive Findings in Year 1 & 2: Total and Illicit Positives

		Year 1	Year 2
Positive Events			
Total	No.	42	27
	%	24.0	15.3[a]
Illicit	No.	38	25
	%	21.7	14.2
Positive Employees			
Total	No.	49	36
	%	6.66	5.44
Illicit	No.	45	34
	%	6.11	5.14
Positive Substances			
Total	No.	53	40
Illicit	No.	49	38

a - The proportion of positives in the second year was significantly different from the first year. $p<0.05$.

The decrease in positives detected from the first to the second year of analysis at CHT represents an encouraging trend. However, consideration of the findings at the initial testing facility to allow comparison of positives over the calendar year offers another perspective (figure 2). The total number of illicit positive findings did not vary from calendar year 1987 to calendar year 1988. As seen in figure 2, there is some variance over time in the positive findings. Therefore, it may be premature to suggest that a decline in the rate of positive drug and alcohol findings has occurred during the course of mandatory post-accident testing by the FRA.

Figure 2. Rate of Positive Findings Comparing Calendar Year versus Analytical Facility Year.



Substances identified in the positive specimens are listed in table 7. Cannabinoids were consistently the most commonly encountered drug in both years of the program. Cocaine/metabolite, followed closely by ethanol were the next most commonly encountered substances. An occasional non-prescribed benzodiazepine, barbiturate or opiate was detected as well as singular methaqualone and amphetamine identifications. Consistent with the decrease in total number of substances noted during year 2, there was a general decline in the number of specific substances detected. Cocaine/metabolite, either by itself, or in combination with cannabinoids, was a notable exception.

Table 7. Comparison of Drug Findings in the First Two Years of FRA Drug and Alcohol Testing

Drug Group	Yr #1	Yr#2
Barbiturates	0	4.[a]
Benzodiazepines	2.[b]	0
Cannabinoids	30	17
Cocaine	5	7
Ethanol	5	3
Methaqualone	1	0
Phencyclidine	0	0
Opiates	3.[c]	1
Cannab/Cocaine	1	3
Cannab/Opiate	0	1
Cannab/Cocaine/Amphet.	1	0
Barb/Opiate	1	0
Total	**49**	**36**

a - Two of the positive barbiturates were prescribed medication.
b - One of the benzodiazepines was prescribed medication.
c - Three of the positive opiates were prescribed medication.

In order to facilitate the integration of positive drug or alcohol findings into accident investigations, blood concentrations of detected analytes are required. Blood concentrations for the combined positives found in years 1 and 2 are presented in table 8. The proportion of positive cases with reportable values in blood varied by drug group. For example, in all cases where both blood and urine were available, the analyte was detected in both tissues for all cases involving ethanol and benzodiazepines, and in 80% of the barbiturates. At the other extreme, only 1 of the 6 opiate positive cases had a positive blood concentration. Additional differences were observed when both a parent drug and metabolite were analyzed. For cannabinoids, blood THC and the carboxy-THC metabolite were observed in 42% and 96% of the positive cases, respectively. Benzoylecgonine (a metabolite of cocaine) was detected in the blood of 65% of the positive cases. Parent cocaine was only detected in 1 blood (6%) and in 53% of the urines. This variation in blood positives depends, in part, upon the intrinsic pharmacokinetics of the drug, the length of time to specimen collection, and for cocaine in particular, the in vitro stability of the drug.

Table 8. Occurrence of Drugs and / or Metabolites in Blood and Urine of Positive Cases

Drug Group	Total / Drug Group	Blood / Tissue	Urine
Cannabinoids	53		
THC		22	ND.[a]
COOH-THC		51	53
Cocaine/Metabolite	17		
Cocaine		1	9
Benzoylecgonine		11	17
Opiates	6.[b]		
Morphine		0	2.[c]
Codeine		1	5
Amphetamines	1		
Amphetamine		0	1
Methamphetamine		0	1
Barbiturates	5.[d]		
Butalbital		4	5
Benzodiazepines	2		
Diazepam		1	NA.[f]
Chlordiazepoxide		1	1
Methaqualone	1	1	0
Ethanol	8	8	6.[g]

a - ND: not determined
b - 3 of 6 opiates were prescribed
c - There was one morphine only case and it was 6-MAM positive
d - 2 of 5 barbiturates were prescribed
e - 1 of 2 benzodiazepines were prescribed
f - NA: not available
g - Urine NA for 2 cases

RELATIONSHIP OF POSITIVE SUBSTANCE FINDINGS TO ACCIDENT CAUSATION AND FATAL EVENTS

While the determination of a drug or alcohol presence in blood or urine specimens is readily performed, a thorough investigation into the causal factors involved in an event is much more time consuming. Many of the events which occurred in the first year of analysis at CHT, and were associated with a positive drug or alcohol finding have undergone a thorough investigation by the FRA and/or the National Transportation Safety Board (NTSB). Administrative decisions have been reached concerning the

contribution of substance use to accident causation (FRA, 1989; NTSB, 1988; Moody, et al., in press). The results of these investigations, including the extent of the investigation are shown in table 9.

Table 9. Drugs Potentially Related to Accident / Incident Causation in Qualifying Railroad Events (First Year Data Only)

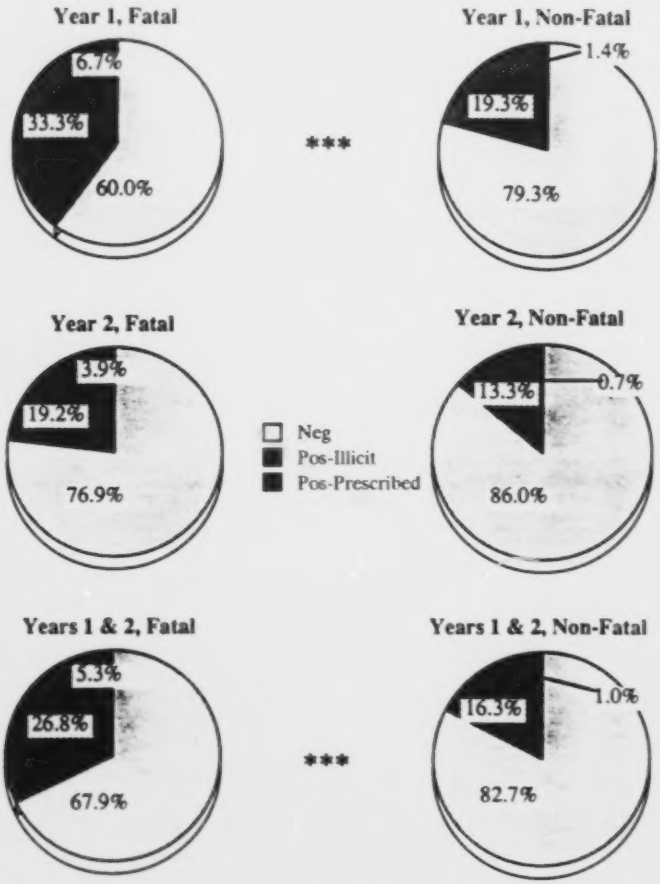
	Extent of Investigation				
	Total No. Investigated / Identified	FRA & NTSB	FRA	NTSB	Total No. Related to Accident
		No. Related/No. Investigated			
Cannabinoids	22 / 30	2 / 12	0 / 1	3 / 9	5
Cocaine	4 / 5	3 / 4			3
Opiates	3 / 3	0 / 1	0 / 1	0 / 1	0
Ethanol	4 / 5	1 / 1		2 / 3	3
Benzodiazepines	2 / 2	0 / 1	0 / 1		0
Methaqualone	1 / 1	0 / 1			0
Cannab. & Cocaine	1 / 1		1 / 1		1
Cannab., Coc. & Amphet.	1 / 1			1 / 1	1
Barbiturate & Opiate	1 / 1	1 / 1			1

Two points of particular interest can be derived from these data. First, while cannabinoids were the most commonly encountered drug, only a small proportion of cannabinoid use, in contrast to the relatively high proportion of cocaine and ethanol use, was associated with event causation. Secondly, all of the 3 instances of multiple drug use detected during the first year of the program were associated with event causation. As there was a marked increase in the number of multiple substance findings in the second year, it will be of particular interest to monitor this trend.

During our initial evaluation of data from the first year of testing, we noticed a greater proportion of the total positives in fatal events. We have further evaluated the data to see if this trend continued, and if it has held for illicit, as well as, total positive findings (figure 3). While the proportions of total and illicit positive event findings in fatal events were consistently greater in the first and second, or combined years of analysis, these proportions were statistically significantly greater for only the total positives in the first and combined years. For the first year data, the rate of positives associated with accident causation could also be determined. In this case, 10.0% and 7.6% of the fatally and non-fatally triggered events, respectively, were associated

with a positive finding of substance use which was determined to play a role in event causation. The difference between the two groups was not statistically significant however (Moody et al., in press).

Figure 3. The Percent Positives in Fatal versus Non-Fatal Qualifying Events.



*** **The proportion of total positives in the non-fatal events was significantly less than for the fatal events, $p < 0.05$.**

COMPARISON TO OTHER TRANSPORTATION STUDIES

Studies on the use of drugs or alcohol in the transportation workplace are limited. Only two other studies have been published to date concerning the results of analysis for drugs and/or alcohol by employees within the transportation industry. These include results of the drug testing program of a single railroad company (Taggart, 1989), and of a study conducted with truck drivers who were randomly chosen to volunteer for testing (Lund et al., 1988). It is interesting that in the study with company sponsored testing of railroad employees, and in the post-accident testing of a similar segment of railroad employees there were comparable positive rates of 5.8 and 6.7%, respectively, in 1987. A higher positive rate was found in the study on truck drivers. The proportion of cannabinoid and cocaine positives were fairly similar in all 3 studies, while ethanol was observed more frequently in the company sponsored testing of railroad employees. Illicit amphetamine / methamphetamine use was modest in the truck drivers (1.3%), but greater than that observed in the railroad post-accident testing program.

CONCLUSIONS

The results of two years of analysis of blood and urine specimens collected after events which qualify for the FRA's mandatory post-accident testing program indicate that, as with other segments of the American workplace, substance abuse is a detectable problem among railroad workers. Specific points which may be concluded from observation of the data from the first and second years of the program are as follows:

- A decrease in the number of employees tested in year two arose from decreased number of employees tested per event. In part, from greater discretion in the number of employees tested for impact accidents and fatal incidents.

- Cannabinoids were the most common positive finding (62.4% of drugs identified), followed by cocaine (20.0%), and ethanol (9.4%).

- Positive findings were more common in fatal than in non-fatal qualifying events.

- In approximately 1/3 of positive events, alcohol or drug usage was related to accident causation.

- A trend towards a decrease in the cannabinoid positives and increases in cocaine, ethanol, and multiple drug positives was noted in drug-related accidents.

On-the-job drug and alcohol use is a continuing problem in the American workplace, and its existence cannot be ignored. One could take the optimistic view that of 1398 railroad employees tested for drugs and alcohol, only 85 tested positive. However, in eleven events studied during the first year, substance use was a contributing factor in the cause of accidents which resulted in the unnecessary loss of property and human life.

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Drug Use and Job Performance Indicators

Development of Repeated Acquisition Methodologies: Implications for the Detection of Drug-Induced Disruption in Human Learning

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INTRODUCTION

Drug testing via urinalysis is the most commonly used method to reduce drug use in the work-place (Walsh and Yohay, 1987). Questions of rights to privacy, differentiating therapeutic drug use versus drug abuse, the absence of alcohol in many testing profiles, and difficulties in maintaining the accuracy of testing programs in populations with a low prevalence of drug abuse may limit the utility of urine testing (Morgan, 1984; Schnoll and Karan, 1989). With respect to avoiding accident or injury, test results are usually not immediately available and indicate only that a drug has been taken in the last several days, not whether an individual is currently under the influence or impaired (Marshall, 1988; Schnoll and Karan, 1989). Thus, urine testing does not test for what is certainly an important concern of employers and regulatory agencies; i.e., behavioral impairment.

One way to avoid several of the detriments of drug testing may be to supplement it with a determination of behavioral impairment. Determining whether an individual is behaviorally impaired at the job-site does not invade that individual's right to privacy, but addresses whether their job can be performed competently and safely. Such a determination could be conducted on a daily basis with the result being immediately available. Ideally, impairment resulting from a variety of sources, including alcohol, abused drugs, and therapeutic drugs producing adverse effects, as well as, sleep deprivation, and/or negative-life events, would be identified. Once an individual is identified as behaviorally impaired, then a variety of techniques could be used to ascertain the cause of that impairment, including field sobriety tests, urinalysis, and psychological tests.

If a behavioral impairment criterion is to be useful, then there must be procedures to assess impairment. To our knowledge, an adequate methodology does not yet exist. Research on the psychopharmacology of drugs on human performance has often developed batteries of performance

procedures. However, many of these procedures are not well-suited for the workplace. For example, the procedures may require protracted training, long periods of time to administer the test, and may not have been developed for within-subject study, or be adequately sensitive to the wide range of drugs necessary in a workplace application.

We have been modifying a method that may be useful in determining behavioral impairment. The procedure is the Repeated Acquisition of Behavioral Chains (Boren, 1963). This procedure permits learning to be studied repeatedly in a single individual (an important point for assessing drug-induced disruption). We selected a procedure to measure learning because most workplaces require employees to adjust their performance as environmental demands change; that is, they are constantly learning how to do their job under the different circumstances that present themselves. We also study learning because numerous studies have demonstrated that drugs disrupt learning more easily than performance (Barthalamus et al., 1978; Bickel et al., 1989; Bickel et al., 1990; Higgins et al., 1987; Higgins et al., 1989; Thompson and Moerschbaecher, 1979).

The purpose of this paper is to describe this procedure, the results we have obtained with it, and our development and modification of this procedure to eliminate undesirable features. Before discussing this work, we would like to make it clear that several of our results are preliminary, and the final results or procedure may differ in subsequent reports.

The Repeated Acquisition of Behavioral Chains

In this procedure, subjects have to learn a sequence of 10 responses to 3 keys. Figure 1 illustrates a typical response sequence in which subjects would have to depress response keys in the order of 3, 1, 2, 3, 2, 1, 3, 2, 1, 3 in the presence of the video screen numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, respectively, for a point to be obtained. For example, as each number appeared in the center of the video screen, subjects had to depress one of the three keys to advance to the next step in the 0 to 9 sequence. Incorrect responses initiate a 2-second timeout: then the subject returns to the step in the sequence in which the error was made. Responses during the timeout have no effect. Correct responses increment the numbers in the 0-9 sequence. Completion of the correct 10-response sequence increments a counter which awards points redeemable for money (e.g., $0.05/point) and returns the subject to the beginning of the sequence. Typically, we study this procedure in a multiple schedule arrangement in which one component is acquisition (a new sequence of responses is learned each session) and the other component is performance (the same sequence is always used).

Among the most important measures obtained from this procedure is errors. Errors are defined as responses on any key other than the one designated as correct at a particular step in the 0 to 9 sequence and are typically analyzed as overall percent errors for each component by dividing the total errors in the component and multiplying by 100.

The development of stability during training for three typical subjects is shown in figure 2. Percent errors in the acquisition and performance components reached stability by the fifteenth session in subjects AK and PP.

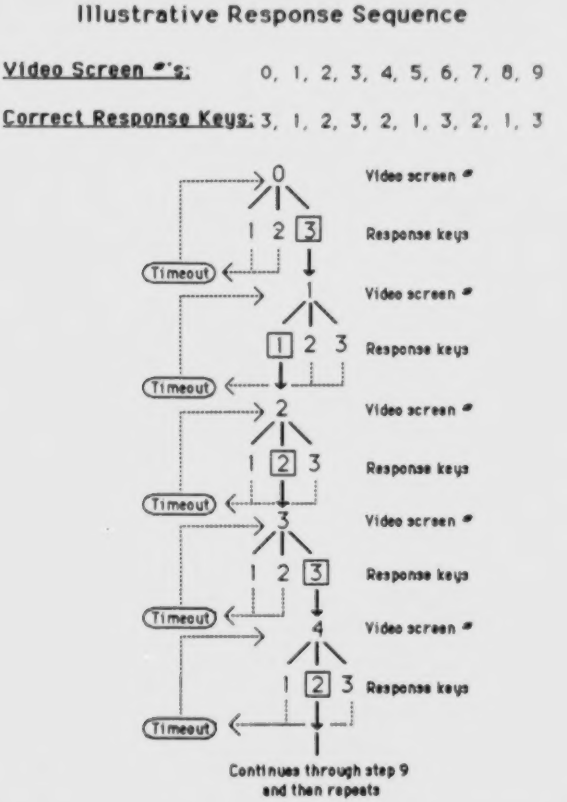
Illustrative Response Sequence
Video Screen #'s: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Correct Response Keys: 3, 1, 2, 3, 2, 1, 3, 2, 1, 3
Video screen #
Response keys
Timeout
Continues through step 9
and then repeats

Figure 1. This figure illustrates the steps involved in moving through a typical 10-response sequence used in the study. At the top of the figure, the 0 to 9 sequence, which appeared in the center of the video screen, is presented above the corresponding 10 correct responses on the numeric keypad. Correct responses advanced the video-screen number to the next step in the sequence. Incorrect responses initiated a 2-second timeout; completion of the timeout period returned the subject to the step in the 10 response sequence at which the error was made. Each completed sequence added one point to a running total and returned the number in the center of the video screen for the start of the next trial (After Higgins et al., 1987, p. 2).

However, some subjects, such as subject GK required as many as 40 sessions of training to reach stability. Stability in the acquisition component is characterized by 2.5 to 7.5 percent errors and in the performance component by 0 to 1 percent errors.

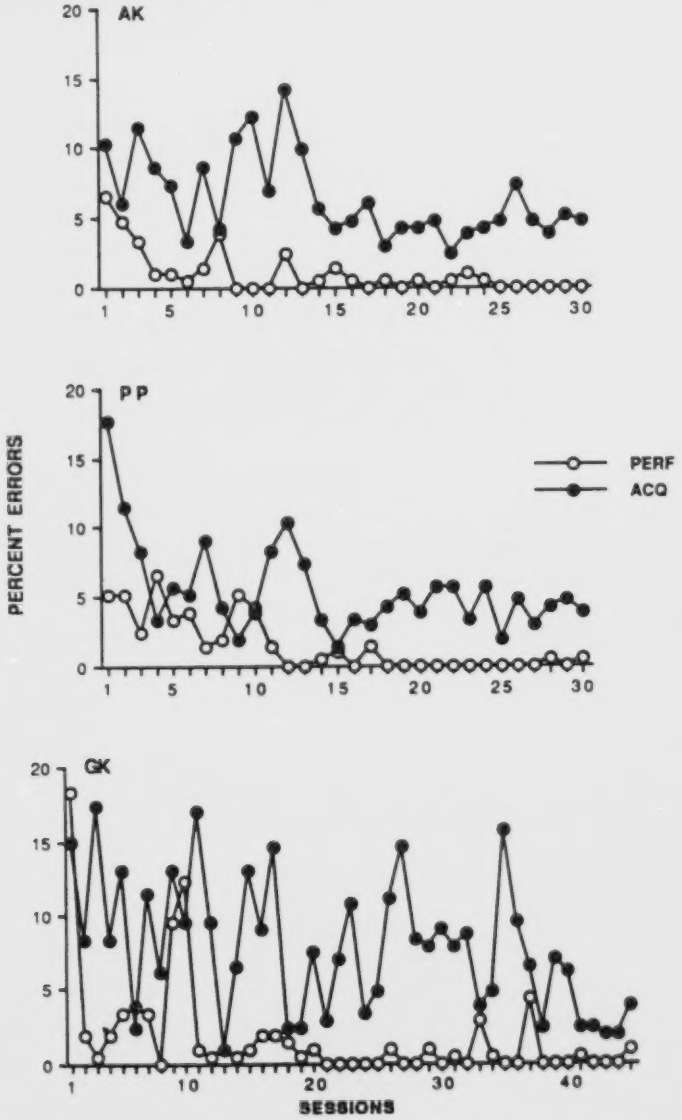

Figure 2. Percent errors during the first 30 to 45 sessions of exposure to the acquisition and performance of response chains procedure.

Acute Effects of Benzodiazepines on Repeated Acquisition

We have recently investigated the acute effect of the prototypic benzodiazepine, diazepam, and two triazolo-benzodiazepines (alprazolam and triazolam) on the acquisition and performance of response chains. Diazepam, widely used as an anxiolytic (Greenblat et al., 1983), produces sedation and decreases psychomotor performance. Alprazolam, an anxiolytic and antidepressant, has been reported to have fewer side effects than diazepam (Fawcett and Kravitz, 1982). Triazolam is used as a hypnotic agent and has been suggested to be the benzodiazepine with the greatest abuse liability (Crawford, 1981; cf. Griffiths and Roache, 1984).

The effects of these drugs on acquisition and performance of response chains of three representative subjects are displayed in figure 3. This figure shows the peak effect of the different doses of these drugs on percent errors from the acquisition and performance of response chains. In the performance component, alprazolam at the 2 and 3 mg/70 kg dose and triazolam at the 0.75 mg/70 kg dose produces effects clearly above placebo levels. In the acquisition component, the drugs could be more easily distinguished. Alprazolam produced the greatest increase in errors followed by triazolam. Diazepam produced a more modest increase in errors relative to the two triazolo-benzodiazepines which is consistent with our previous findings with diazepam (Higgins et al., 1987).

There are two points to make about these results. First, performance or performance-like tasks are relatively insensitive for the assessment of drug-induced impairment. Thus, tests of performance probably underestimate the degree of drug impairment. Second, diazepam seems less disruptive than either of the two triazolo-benzodiazepines at equipotent therapeutic doses. This suggests a structure-function relationship in which the addition of the triazolo-ring to the benzodiazepine molecule may imbue these compounds with greater liability for disrupting learning than other standard benzodiazepines.

With respect to assessment of behavioral impairment, the repeated acquisition of behavioral chains has several advantages and disadvantages. Among the advantages is the ability to study learning repeatedly in a single subject, and its greater sensitivity to drug effects than performance. A major disadvantage of the procedure is the protracted period of time required for training (up to 40 sessions) which renders this procedure relatively impractical for the detection of drug-induced disruption in work site settings.

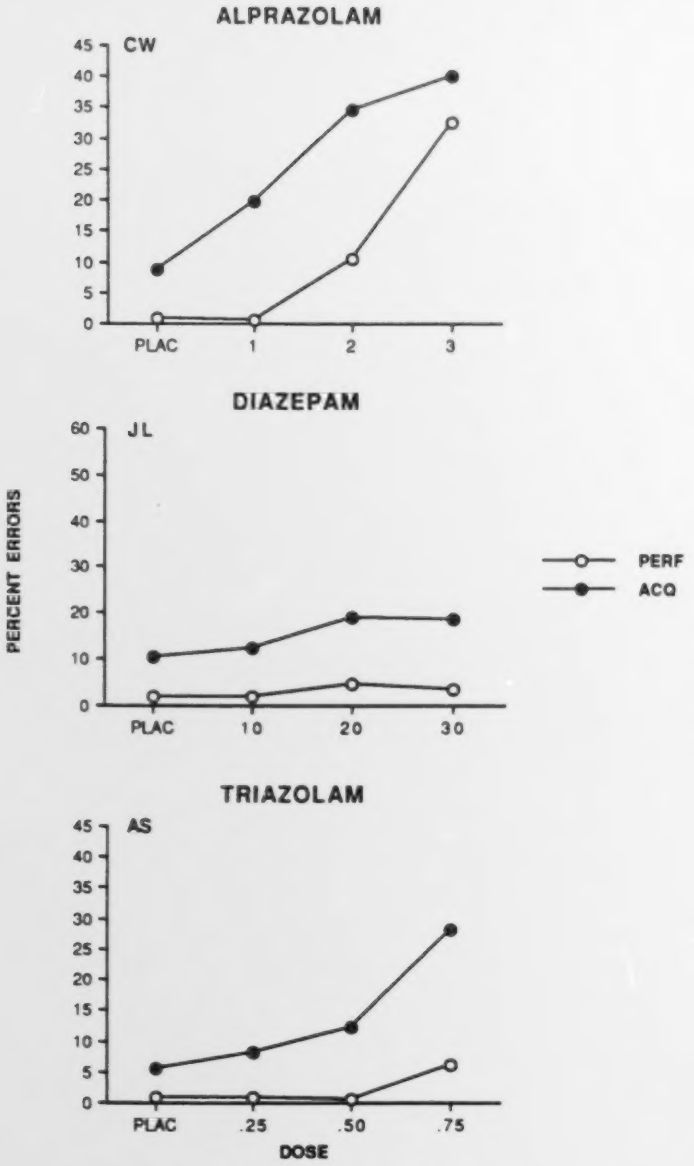

Figure 3. An individual subject's data for the effects of alprazolam, diazepam and triazolam on overall percent errors. Each point represents peak effects of that dose.

THE REPEATED ACQUISITION OF STIMULUS TRACKING

To overcome the prolonged training, we have modified the repeated acquisition methodology to produce a new task--the Repeated Acquisition of Stimulus Tracking (RAST). This task was designed to reduce the training period by requiring that only 1 response be acquired relative to the 10 responses acquired in the repeated acquisition of behavioral chains. Moreover, in order to increase complexity, and hopefully sensitivity, to drug effects, the number of potentially correct responses was increased.

The RAST presents subjects with five response areas on a video screen (top left panel figure 4). Within each response area are 5 stimuli for a total of 25 stimuli. Only 1 of the 25 stimuli is correct. If the subject responds (by pointing with a Macintosh mouse and clicking) to a response area containing the correct stimulus, then feedback is provided that one of the five stimuli is correct (i.e., a beep and a point). If none of the five stimuli is correct in a given response location then the subject receives no feedback. On each successive trial the five stimuli that were together on a previous trial are generally not together on the next trial. When the subject has learned which is the correct stimulus (i.e., acquired the correct discrimination), the correct stimulus is tracked as it moves from response location to response location. Similar to the previous procedure, the RAST has acquisition and performance. In the acquisition component, the subject has to learn which 1 of the 25 stimuli is correct and this changes each session. In the performance component, the same stimulus is correct each session.

An example of how a subject might respond on the RAST during the first several trials in the acquisition component is illustrated in figure 4. On trial 1 (upper left panel), the subject might respond to the upper left response area. However, the correct counter is not incremented. This indicates that none of the five stimuli in this response location is correct. On trial 2 (upper right panel), the subject responds to the response area located in the center of the screen. Again, this response does not increment the correct counter indicating that none of these stimuli is correct. On trial 3 (middle left panel), the subject again responds to the upper left response area and does increment the correct counter indicating that one of these five stimuli is the correct stimulus. If the subject had learned from trials 1 and 2 which stimuli were not correct (i.e., the eye and the building), then the subject would have only three stimuli from which to select to determine which stimulus is correct. On trial 4 (middle right panel), the subject responds to the lower right response area, and does not increment the correct counter. This response area contains both the cross and the eyeglasses that were previously correlated with reinforcement but on this trial did not increment the correct counter. Thus, these two stimuli are not the correct stimuli leaving only the television. On trial 5 (bottom left panel), the subject responds to the

response location containing the television and increments the response counter. On trial 6 (bottom right panel), the subject tracks the television to its new response location. In the acquisition component, a new correct stimulus would need to be learned in the next session and the process repeated. If this were a performance component, the same stimulus would be correct each session.

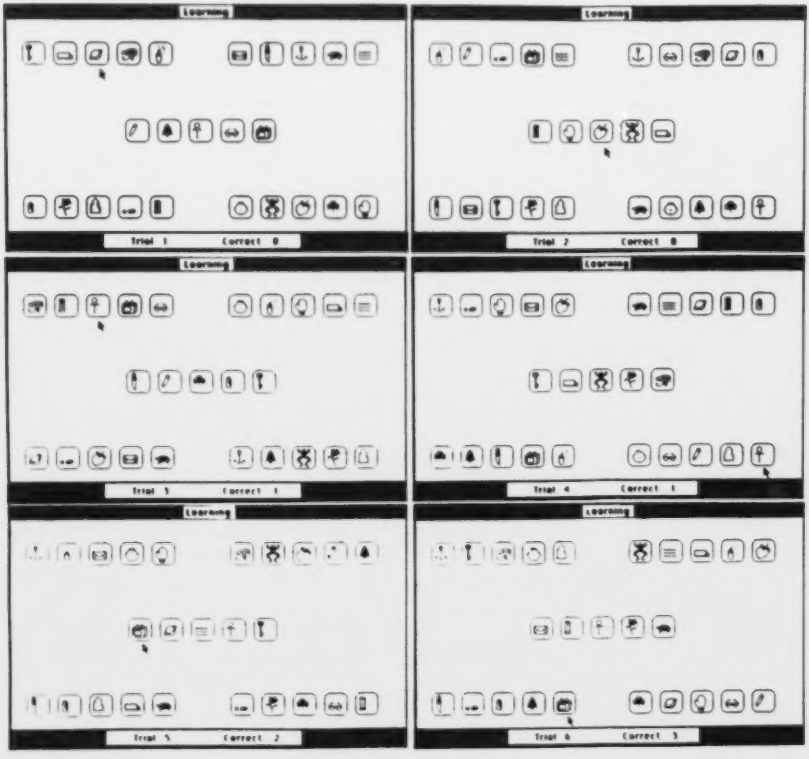

Figure 4. This figure illustrates the six trials during the acquisition of the correct response during exposure to the RAST. Each response moves the subject to the next trial and increments the trial counter at the bottom of each screen. Incorrect responses have no effect.

Again, the primary measure for this procedure is errors. Figure 5 shows the development of stability of the RAST for three subjects. Subjects reach stability in the acquisition component in two to four sessions with percent error ranging from 0 to 30 percent error. In the performance component stability is reached within three sessions and stable performance is characterized by the absence of errors.

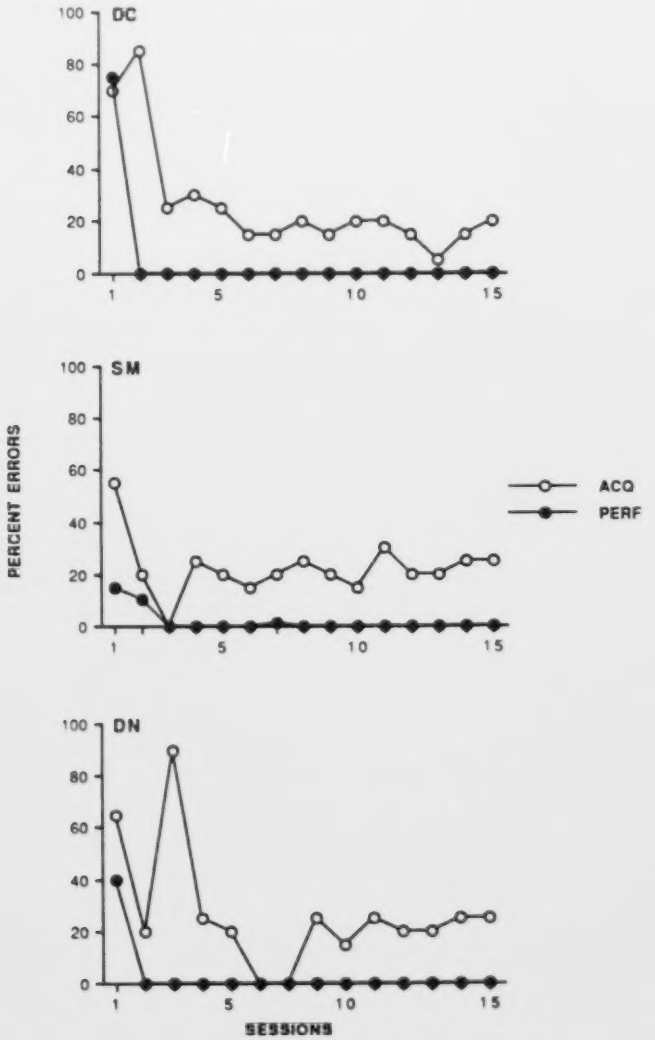

Figure 5. Percent errors during the first 15 sessions of exposure to the acquisition and performance of stimulus tracking procedure.

We then examined the effects of triazolam (0, 0.375 and 0.75 mg/70kg, p.o.) on the procedure. Figure 6 shows the results of a representative subject who received triazolam 30 minutes earlier. Triazolam produced a dose-related increase in errors in the acquisition component of the RAST with 100% errors being obtained with the high dose. In contract to the acquisition component, the performance component is very insensitive to triazolam's effects.

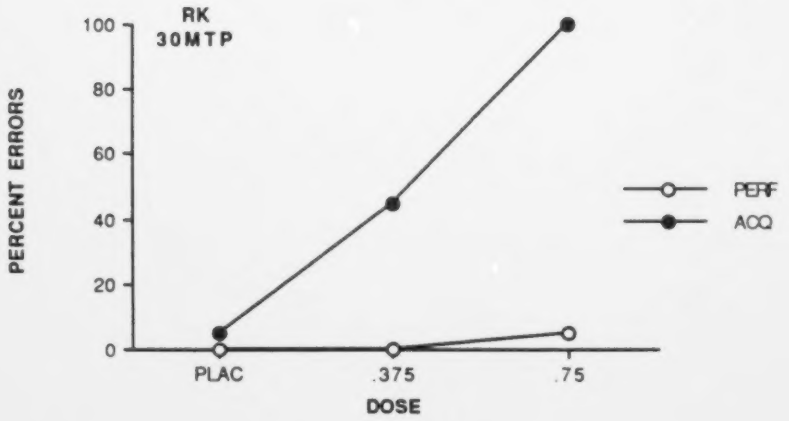

Figure 6. An individual subject's data for the effects of triazolam on overall percent errors from the acquisition and performance components of the RAST. Each point represents percent errors 30 minutes post-drug administration.

CONCLUSION

The RAST is easily learned, quickly administered, sensitive to triazolam's effects and may be a useful component of a battery designed to assess behavioral impairment in the workplace. The development of the RAST illustrates one approach to the development of procedures to assess behavioral impairment; that is, a procedure that has desirable features is modified in an attempt to decrease or eliminate undesirable and enhance desirable features.

As indicated earlier, the addition of behavioral impairment assessments offers several advantages over urinalysis testing alone. Perhaps, if such tests of behavioral impairments were in place, workplace accidents could be decreased. However, before such a battery can be utilized, a considerable amount of research will be required specifically directed toward customizing promising procedures so they are suitable for the workplace environment. Only when that research has been conducted can the advantages of assessing behavioral impairment be realized.

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Residential Laboratory Research: A Multidimensional Evaluation of the Effects of Drugs on Behavior

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There are surprisingly little published data describing the effects of currently abused drugs on human performance. Evaluation of such effects remains an important issue, particularly, for example, where workplace safety and productivity are at risk. Concerns center both on changes in performance immediately after drug use as well as decrements in workplace performance related to drug use outside of the workplace. These decrements have not been easy to document, in part because contextual issues play a relatively large role in the manifestation of drug effects. For example, a number of studies have reported that instructional and social factors can influence the effects of marijuana (Carlin et al., 1972; Jones, 1971). Given the importance of contextual factors for the measurement of drug effects, assessment of drug effects on work performance should be conducted under the conditions in which the drugs are generally taken and the tasks carried out. Such evaluations enable us to carry out analyses of the interactive effects of situational factors and behavioral contingencies with the various drugs in question.

Another aspect of the complexity involved in assessing drug-related performance decrements related to drug use is the fact that drug-taking under social (or nonwork) conditions has the potential to affect workplace performance. Such effects are difficult to measure. We have little information on such issues as possible "hangover" or "morning after" effects of the use of illicit drugs. Several studies have suggested, for example, that marijuana use may result in subtle behavioral changes the next day (Yesavage et al., 1985; Chait et al., 1985), but these have not systematically evaluated the relevant variables under the conditions in which people smoke marijuana.

A broad spectrum of stimulus conditions play a role in drug-taking and its effects. This paper describes a small group residential laboratory that provides an opportunity to evaluate this range of variables. Continuous long-term residence permits control over extraneous influences unrelated to experimental manipulations and allows for relatively precise description and

control of stimulus conditions in effect at a given time. Experimental days can be structured to approximate schedules outside the laboratory, and a full range of performances can be recorded both automatically and by trained research assistants using reliable observational techniques. Under these circumstances, the effects of the drugs being self-administered, as well as the pattern of self administration of these drugs, can be studied under conditions closely approximating those in which drugs may be taken outside of the laboratory.

THE PROGRAMMED ENVIRONMENT RESEARCH LABORATORY

The Programmed Environment is a residential laboratory designed for continuous observation of human behavior over extended periods of time (see Brady et al. 1974 for a complete description). The laboratory, diagrammed in figure 1, consists of five rooms connected by a common corridor. The three identical private rooms are similar to small efficiency apartments with kitchen (stove, refrigerator, sink, microwave oven, and preparation area) and bathroom facilities, a bed, desk, chair and other typical furnishings. The social area is equipped with tables, chairs, sofa beds, storage cabinets, video games, a monitor for viewing videotaped movies, and a complete kitchen facility. The workshop provides additional social space and contains benches, stools, storage cabinets, tools, exercise and recreation equipment, and a clothing washer and dryer. A common bath serves all the social areas. Access to the exterior of the laboratory is provided by a corridor which encircles the environment between the residential chambers and the exterior building shell. This permits transfer of supplies and materials through storage facilities (drawers and cabinets) accessible from both sides of the residential walls.

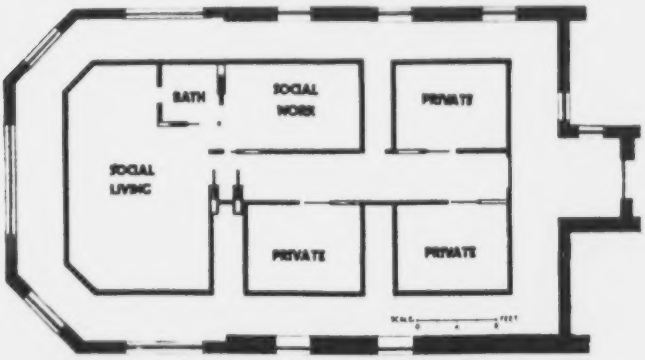

Figure 1. Diagrammatic representation of the floor plan of the Programmed Environment Research Laboratory and its arrangement within the external building shell.

Thus, experimenters can introduce or remove supplies and material as required. Access to supplies, activities or areas can be carefully controlled by the experimenters. Each room of the laboratory has one door which remains unlocked at all times in case of emergency or subject termination of participation.

One subject resides in each of the three efficiency apartments. All have access to the other areas at programmed times. Subjects remain within the residential laboratory throughout the duration of the study, coming in contact only with each other. An experimental control room, containing computers and audiovisual equipment for monitoring, programming, recording and data analysis, is linked by video display terminals to each of the private and social rooms, allowing for communication between the experimenter and each subject. Audio and video equipment in each room of the programmed environment permits continuous monitoring of each subject's activities during the experiment. Subjects are under continuous observation from the control room except for periods when they occupy the private space around the bed and bathroom areas. A computerized observation program provides the structure for continuous recording and categorization of each subject's behavior (Bernstein and Livingston, 1982).

Subjects are awakened at 9 a.m. Each is weighed, washes and dresses, and receives a box containing a wide variety of snack and meal items which are available through the day and evening. Each is given the opportunity to prepare and eat breakfast. The experimental day generally begins at 10 a.m., and is divided into two equal parts: a 6 3/4-hour private work day, and a 6 3/4-hour social access evening period. Standardization of session lengths facilitates experimental observation and data interpretation. Food and beverages are available at any time during the course of the day and evening. Between 10 a.m. and 4:45 p.m., the private work period, subjects are required to remain in their private rooms and engage in one of four work tasks. These have generally been: a computerized vigilance task, a computerized digit-symbol substitution task, a colored disk sorting task, and a manual word alphabetizing task. More recently, we have substituted two more automated tasks, a learning task and a time estimation task, for the two manual tasks. Subjects have the option of performing any of the four available tasks, although they are required to perform one of them at all times other than during a 30 minute break. Between 5 p.m. and 11:45 p.m., subjects can remain in their rooms and engage in a variety of individual activities including reading, writing, artwork, etc., or they can move to the social areas where interactive group activities, videotaped movies, and games are available. The experimental day ends at midnight with lights out. Structuring the day and providing appropriate contingencies are important for keeping volunteers in studies in which they are expected to maintain continuous residence in the

laboratory for periods of several weeks. Although this is the general structure of most studies, it is not difficult to change the structure to address specific issues (e.g., change the order of the work and social access periods or manipulate the amount of time apportioned for each of these, or change the task requirements). We have also manipulated motivational factors by paying money for specific behaviors or by requiring subjects to engage in low probability behaviors in order to have access to high probability (and presumably reinforcing) activities.

As part of the behavioral observation monitoring program, talking is scored during social access periods. We are thus able to categorize social behavior as coaction (two or more people present in the same room without any speech) and interaction (two or more people present in the same room with one or more of them speaking). Such analyses allow for a fine-grained description of the effects of various drugs on social behavior, providing the necessary information for the prediction of these effects in the natural ecology.

Food intake is also monitored throughout the course of these studies. Subjects send a message via the networked computer system whenever they eat or drink anything. Time and amount of all food consumption is recorded. These data are verified through observation. Previous research in this facility has shown that food reporting does not disrupt eating patterns and gives accurate information on pattern and amount of intake during the day (Foltin et al., 1986). Such data provide information about additional aspects of a specific drug's effects, and can verify, in the absence of other generally observable changes in behavior, that a biologically significant dose of the drug has been administered.

Tobacco cigarette smokers are free to smoke cigarettes ad libitum during these studies as long as they do so through the cigarette holders which are provided (coded for each subject) through the laboratory. These holders monitor each puff, and the data are automatically collected for later puff analysis. Changes in patterning and/or number of tobacco cigarettes smoked while under the influence of an experimentally administered substance provide additional information about the effects of these compounds on behavior.

DRUG ADMINISTRATION

Marijuana and amphetamine have been evaluated in the Programmed Environment laboratory. One-gram marijuana cigarettes, provided by the National Institute on Drug Abuse, were available in tetrahydrocannabinol (THC) concentrations ranging from 0 percent (placebo) to 2.8 percent. Only volunteers with histories of marijuana smoking were accepted for

participation in the marijuana studies. In general, subjects were given the opportunity to smoke either the placebo dose or the 2.8-percent dose, under carefully controlled conditions, four or five times daily. Subjects took five puffs per cigarette according to a uniform puff procedure signalled by a series of colored lights. This procedure provides a 5-second warning signal followed by a 5-second signal to inhale, a 10-second signal to hold the smoke in the lungs and a 40-second signal to exhale and wait for the next puff. This pattern of stimulus cues is repeated once a minute for a total of five inhalations, and in most cases results in complete pyrolysis of the cigarette. Utilization of the paced smoking procedure produces reliable changes in heart rate and THC blood levels (Foltin et al., 1987).

An elixir containing 10-milligrams d-amphetamine, or the elixir alone (placebo) was administered twice daily, at 9:20 a.m. and at 4:30 p.m. Both daily doses were either active or placebo drug, and subjects were carefully observed to insure consumption of the entire beverage.

EATING BEHAVIOR

Smoked active marijuana significantly increased total daily caloric intake by an average of 40 percent above placebo levels in the six subjects whose data are shown in figure 2 (Foltin et al., 1988).

For five of the six subjects participating in this study, the greatest change in food intake occurred during the social period, and for four out of six, differences in caloric intake under placebo and marijuana conditions were evident on the first day of active drug administration. Active marijuana significantly increased caloric intake from snack foods (foods requiring no preparation), nearly doubling the number of snack occasions (figure 3; Foltin et al., 1988). The main significant increase in snack food consumption was the increase in intake of sweet solid items.

Unlike marijuana effects on performance (discussed below), these marijuana-induced increases in food consumption were observed throughout the day, independent of time of drug administration.

Administration of d-amphetamine, on the other hand, as might be predicted, decreased food consumption to approximately 70 percent of placebo levels as a consequence of a decrease in the number of eating occasions per day across both snacks and meals (figure 4; Foltin et al., 1990[b]).

There were significantly greater reductions in solid as compared with beverage items. In contrast to active marijuana, amphetamine's effects were not related to snacks versus meals. The differential effects of marijuana and

amphetamine on food intake verified the previously reported contrasting effects of these two compounds (Foltin et al., 1986; Jasinski et al., 1974), and provided evidence for the biological activity of the doses used.

PERFORMANCE EFFECTS

An example of a relatively easily measured performance is the automated Digit Symbol Substitution Task (DSST; McLeod et al., 1982). This computer-presented, perceptual motor task consists of nine random 3-row by 3-column patterns of asterisks and dashes (one asterisk/row) displayed across the top of the screen. The patterns are labeled 1-9 from left to right across the screen, and the label is centered directly below each pattern. A randomly generated number, between 1 and 9, is displayed in the center of the monitor, indicating which of the nine patterns displayed at the top of the

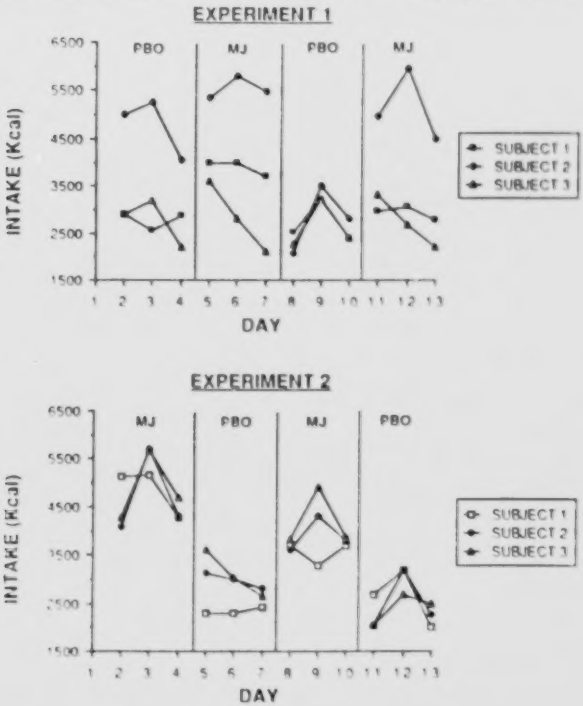

Figure 2. Total daily caloric intake for three subjects in each of two experiments (1 and 2) as a function of day of the experiment. Placebo (PBO) and active marijuana (MJ) administration periods are indicated.

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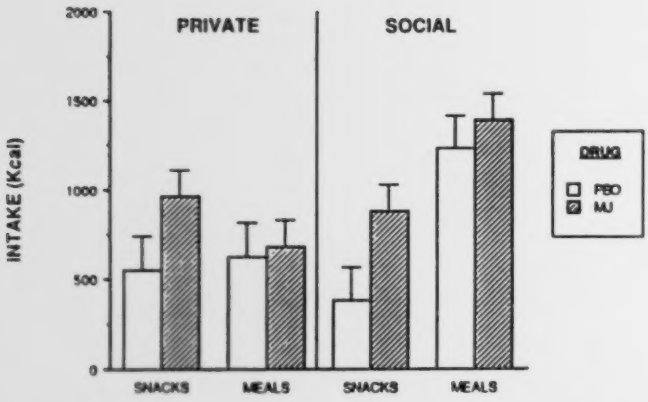

Figure 3. Mean daily caloric intake of six subjects from snacks and meals during the private work period and social access period following placebo (open bars) and active marijuana (hatched bars) administration. Error bars indicate SEM.

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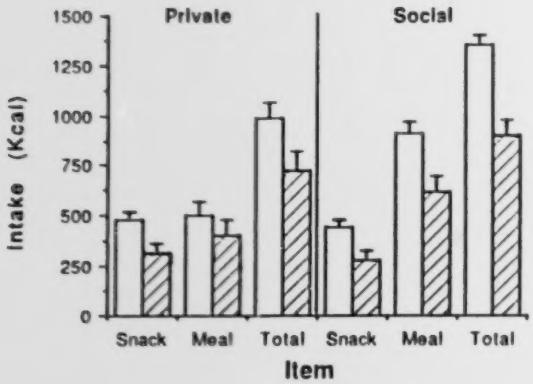

Figure 4. Mean daily caloric intake from snacks and meals during the private work period and social access period following placebo (open bars) and amphetamine (hatched bars) administration. Error bars indicate SEM.

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screen should be copied by the subject on a particular trial. During each trial, subjects are required to press only the keys in a 3-row by 3-column keypad that correspond to the positions of asterisks in the appropriately labeled pattern. Three responses are required per trial (one response in each row, corresponding to the single asterisk in each row), and a new randomly generated number is displayed in the middle of the screen immediately after each trial. Following completion of 25 trials, a new random pattern of dashes and asterisks is displayed at the top of the screen. Subjects determine the rate of DSST trial completion, and performance during successive 25 trial sequences is monitored.

Subjects were given marijuana cigarettes to smoke at 9:45 a.m., 1:30 p.m., 5:00 p.m., and 8:30 p.m. Cigarettes were smoked immediately before, and midway through, both the private and social periods each day. They were all either active (1.3, 2.3, or 2.8 percent ^{9} THC) or all placebo. The effects of smoked marijuana and DSST performance for a single, representative subject are presented in figure 5.

As shown for this subject, changes in DSST performance were related to time after smoking, with maximal effects occurring within the first hour. During the 15-minute interval that immediately followed each placebo marijuana smoking occasion, subjects completed an average of 25 three-response trials per minute and averaged 1 error every 50 trials. In contrast, although overall rate did not change after active marijuana administration, error rates were increased by an average of 40 percent.

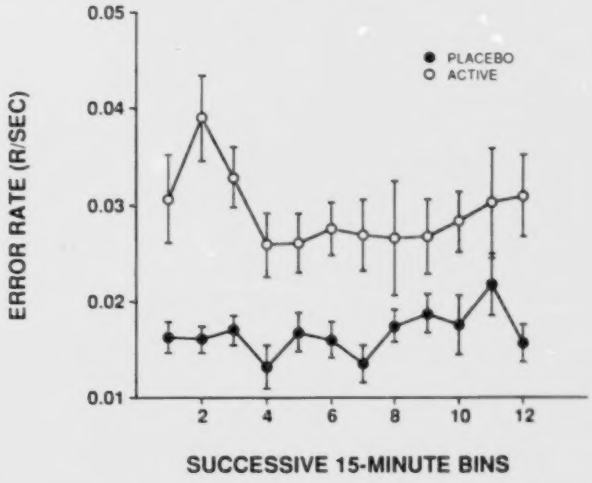

Figure 5. Effects of smoked active or placebo marijuana on error rate during the three hours after smoking a single cigarette.

DSST performance was also changed when 10 milligrams of d-amphetamine were administered 30 minutes prior to the work period. Again, overall response rate was unchanged with the active drug, but error rates were significantly decreased. Drug effects were observed throughout the entire work period. Under these circumstances, in which subjects are performing a relatively boring task, amphetamine facilitated performance. Such effects have been reported for both amphetamine (Laties and Weiss, 1981) and cocaine (Fischman and Schuster, 1980).

THE MOTIVATIONAL EFFECTS OF MARIJUANA

Response hierarchies were determined for subjects during their private work and social periods. This was accomplished by allowing them to choose their activities freely during baseline periods, under conditions of active or placebo marijuana. Time spent in each activity was recorded, and based on the temporal relationships among the various activities, a hierarchy of response probabilities was determined for each subject, separately for private and social periods within both placebo and active marijuana conditions. Subjects were then required to participate on the task with the lowest probability of occurrence in order to obtain access to the activity with the highest probability of occurrence, according to contingency procedures established by

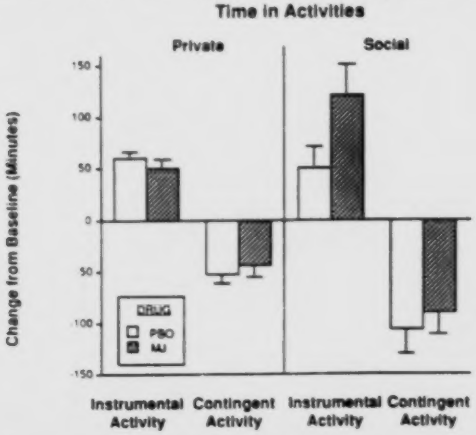

Figure 6. Mean change from baseline time spent engaging in low probability (instrumental) and high probability (contingent) activities under placebo (open bars) and active marijuana (hatched bars) administration. Error bars indicate SEM.

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Premack (1965). This was carried out under active and placebo marijuana conditions (Foltin et al., 1989; 1990a).

Introduction of a contingency requiring subjects to increase the amount of time spent in a low probability work activity in order to earn time to engage in a high probability work activity was effective in modifying patterns of work behavior. During the private work periods, all subjects increased the amount of time spent engaging in the low probability behavior, with significantly smaller increases under active marijuana conditions. This difference between active and placebo conditions, although consistent, was relatively small (approximately 20 minutes per day). In contrast, however, smoked active marijuana was associated with a markedly greater increase in the amount of time spent performing high probability activities during contingency periods, without a concomitant increase in performance of the available preferred activity. That is, under active marijuana conditions during the social access periods of the day, subjects increased their low probability behaviors significantly more than under placebo conditions, thus earning more time to engage in their preferred activities. They did not, however, utilize this time (i.e., consume their reinforcer). This was true despite the fact that the drug had no apparent effect on the time spent engaging in such high probability activities under noncontingent baseline conditions or upon the increases in low probability activity which occurred under contingent conditions. Thus, the administration of active drug differentially altered the response to the contingency arrangement under private and social conditions. This alteration resulted in a suboptimal use of resources during the social periods of the day. It is possible that this change in behavior may be comparable to the behavior changes often referred to as an "amotivational syndrome" and may provide a model for evaluating the change in responsivity to contingencies anecdotally reported to occasionally occur in marijuana smokers. Importantly, the data suggest that these possible "amotivational" effects are dependent on the environmental conditions associated with marijuana smoking.

MARIJUANA SELF-ADMINISTRATION

Laboratory research on drug self-administration has often been criticized because the conditions are not those most commonly in effect when the drug is ingested under "natural" conditions. Marijuana, in particular, is frequently smoked within a social context and the interaction of the marijuana smoker with his or her extended environment must therefore be considered (Goode, 1969). Experimental studies under these more "natural" conditions, in which an unrestricted flow of behavior occurs, might well yield results different from those obtained in relative isolation (Fischman et al., 1988).

Drugs are self-administered under a variety of conditions and according to a broad range of patterns. The behavioral contingencies in effect when the

drug is available no doubt determine, to some extent, the amount and patterning of the self-administration. It is also possible that, under conditions where subjects are allowed to control the pattern of their drug self-administration (i.e., frequency and timing), different effects will emerge.

For example, perhaps the drug will not be self-administered when productive and efficient performance is required, but will be when no consequences are attached to behavioral output.

Standard 1-gram active (1.84 percent THC concentration) marijuana cigarettes, provided by The National Institute on Drug Abuse, were smoked in accordance with our experimenter-controlled uniform puff procedure. Subjects were told that they could request and smoke a marijuana cigarette at any time during the day, up to the maximum of 5 cigarettes. Cigarettes could be smoked in the private rooms all day (9:45 a.m. - 11:45 p.m.), or in the social room during the social access period (5 p.m. - 11:45 p.m.). The study was divided into three 4-day periods, with no work contingencies in the first and third periods and a work contingency present during the middle 4-day period (day 5-8). The work contingency was similar to that described above. Active marijuana cigarettes were available on the middle 2 days of each period. Thus, marijuana could be smoked on days 2, 3, 6, 7, 10, and 11. There was a work contingency in effect during days 6 and 7 of the marijuana availability schedule.

Despite the fact that no clocks or other indicators of time were available, subjects generally smoked the maximum number of cigarettes available, in a regularly spaced pattern (Fischman et al., 1988).

With few exceptions, three cigarettes were smoked during the social access period and two during the private period. Two of the subjects always smoked their social period cigarettes in each other's presence, and marijuana availability and consumption was associated with substantial increases in time spent in social interaction. Under conditions of no marijuana availability, these subjects spent an average of 48 minutes ($\pm$4 minutes) interacting, while during periods of marijuana availability these two subjects increased their social interaction time to an average of 225 minutes ($\pm$5 minutes) or 3 3/4-hours. The third subject smoked all marijuana cigarettes in his own room, and rarely interacted with the other two subjects.

Testing of three subjects has been completed in another study currently in progress in our laboratory. The order of daily exposure to the private and social periods was manipulated such that the social period occurred between 5 p.m. and 11:30 p.m. or between 10 a.m. and 5 p.m. over 5-day intervals. The private work period, during which subjects worked for points which could be exchanged for money, rather than preferred activities, occurred in

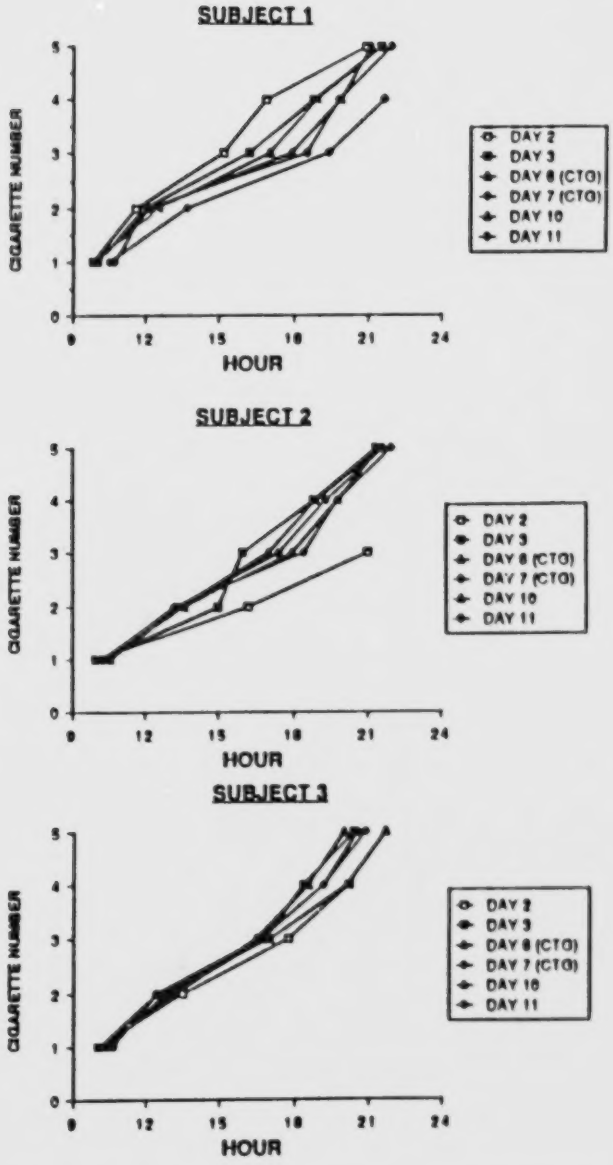

Figure 7. Marijuana cigarette self-administration as a function of time of day over six days of active marijuana cigarette availability.

the alternate time period every day. Under these experimental conditions, subjects consistently smoked a majority of marijuana cigarettes during the social period, regardless of time of day. This behavior suggests that the combination of a period of social access with no work requirements was more likely to maintain marijuana self-administration than was a monetary work contingency under conditions in which subjects were isolated from each other.

These data indicate that when marijuana is made available under relatively naturalistic living conditions, subjects will self-administer it in a regular and stable pattern, with more drug intake during the social portion of the day. When a behavioral contingency was introduced during this period, self-administration of active marijuana was unchanged. No monetary contingency was associated with this behavioral contingency. When a monetary contingency was introduced, most of the marijuana was requested and smoked during the social period, during which subjects were not paid for speed or accuracy of performance.

SOCIAL BEHAVIOR

Marijuana's specific effect on social behavior appears to be related to situational factors. Under conditions in which subjects rarely engaged in coactive (nonverbal) social behavior during placebo marijuana administration, smoking active marijuana had no effect on this behavior, but did result in significant increases in interactive behavior, (verbal behavior under social conditions; Foltin et al., 1987). On the other hand, when subjects readily engaged in coaction as well as interaction under placebo conditions, smoked active marijuana had no effect on the total amount of time subjects spent in the social area but did change the distribution of activity within the social period by increasing coactive social behavior and decreasing interactive social behavior (Foltin and Fischman, 1988). These latter data are consistent with other reports of marijuana-related decreases in verbal responding (Babor et al., 1978; Higgins and Stitzer, 1986), and suggest the importance of baseline social conditions in the measurement of drug effects.

SUMMARY

The data presented point to the importance of studying drug effects under conditions similar to those in which drugs are taken outside of the laboratory. Interactions between the reinforcing and other direct effects of these drugs, as well as their interactions with ongoing environmental events can only be evaluated under such conditions. These data support the utility of a residential research facility for the investigation of substance use and its effects under conditions which approximate those in which people live outside of the laboratory. This unique laboratory, designed for continuous

observation of human behavior over extended periods of time, provides a controlled environment with the flexibility for establishing a range of subject behaviors, and the ability to simultaneously monitor a wide range of individual and social behavior patterns. We can study regulation of drug intake and its effects, both within a day and over days, assessing the effects of experimental manipulations on the patterning of self-administration behavior as well as the performance of a range of other behaviors as a function of drug self-administration. The design of such studies is a logical extension of basic preclinical research, as well as more traditional human behavioral pharmacology research.

Although little data are yet available on drug-related "hangovers" or "morning after" effects, it should be clear that this residential laboratory would provide ideal experimental conditions for such research. We have shown that subjects will exhibit stable patterns of drug self-administration which are sensitive to systematic manipulation of variables. Therefore, we are in the position of being able to evaluate longer term effects on performance of drug-taking behavior as it occurs under conditions approximating the natural ecology. The examples of data collected in the laboratory have demonstrated that drug effects are not a unitary phenomenon, but instead depend on ongoing behaviors as well as pharmacological variables such as drug and dose. If we are going to evaluate drugs and the way in which they affect workplace behavior, we must carry out our evaluation under conditions which approximate those in which people might be using them, while at the same time controlling extraneous variables and protecting the participants from possible deleterious effects. We have shown that drugs, such as marijuana and amphetamine, have divergent effects that are influenced by both situational and behavioral factors. A thorough evaluation of the effects of any drug on behavior is, therefore, dependent on the evaluation of the drug's effects under the conditions in which it is likely to be taken.

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Effects of Alcohol on Human Behavior: Implications for the Workplace

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INTRODUCTION

Alcohol exerts a number of effects on human behavior, many of which have important implications for workplace safety and productivity. One particularly dramatic effect is on the behavior leading up to alcohol consumption. In many contexts, alcohol functions as a potent reinforcer (Mello and Mendelson, 1971; Griffiths et al., 1980); and contingencies associated with alcohol consumption reliably engender chronic alcohol-seeking behavior in a subset of those individuals who are exposed to alcohol. Although the percentage who drink alcohol on a chronic basis is small (e.g., less than 15 percent of full-time employees drink daily), chronic alcohol consumption has a pervasive economic and social influence on the economy (Miller, 1989; Erfurt and Foote, 1989). For example, the measurable cost of alcoholism and alcohol-related problems (i.e., accidents, lost productivity, and health costs) were estimated to be approximately 90 billion dollars per year in the United States in 1980. A substantial portion of these costs fall directly on businesses. Chronic alcohol consumption clearly exerts a significant influence on the workplace.

In full-time employed populations, occasional moderate alcohol use is more prevalent than chronic alcohol consumption. In the United States, most full-time employees have consumed alcohol at some time in their lives, and approximately 70 percent continue to do so at least once per month (Voss, 1989), including, on occasion, before or while working (Bray et al., this volume). While most of these individuals are not chronic alcohol consumers, occasional consumption of substantial amounts of alcohol (e.g., more than five drinks per episode) does occur in this population. Recent findings suggest that residual or "hangover" effects can be observed after substantial alcohol consumption even after blood alcohol levels (BAL's) have returned to zero in occasional, moderate drinkers (Myrsten et al., 1980; Yesavage and Leirer, 1986; cf. Bowden et al., 1988; Collins and Chiles, 1980; Collins, 1980; Dowd et al., 1973). As such, even if alcohol consumption in this population

is restricted to personal time, when employees are not working (e.g., weekends), recent laboratory research suggests that workplace performance may be affected. In addition, employees drink alcohol while working, and such use, even at low levels, can influence performance. Therefore, conceptualizations of the economic and social consequences of alcohol use in the workplace must include considerations of chronic alcohol users, as well as the effects of alcohol on the behavior of occasional, moderate, alcohol consuming employees. This chapter will review laboratory studies of the effects of alcohol on dimensions of human behavior that are relevant to workplace performance.

LABORATORY PROCEDURES FOR MEASURING ALCOHOL'S EFFECTS

The influence of occasional, moderate alcohol use on workplace safety and productivity can be assessed most accurately by directly measuring alcohol's effects in the workplace. However, the workplace is a complex cluster of physical, social, and environmental factors in which a workforce is required to maintain consistent productivity. A multitude of factors are involved in determining the level of performance of any given employee. It is clear that considerations of both individual and group performance at multiple levels are required for a complete account of workplace performance. Given these workplace complexities, monitoring the effects of alcohol directly is difficult. It is also possible to assess alcohol's effects in the workplace by measuring alcohol's effects on performance dimensions that are relevant to the workplace in the more highly controlled conditions of the research laboratory.

A substantial research effort has been devoted to measuring the effects of alcohol on human behavior, and a number of techniques used for this purpose have direct relevance to workplace performance. Largely as a result of concerns over public safety, efforts have been aimed at assessing alcohol's effects on human performance, and procedures that have been developed for this purpose include driving and flying simulators, as well as a range of psychomotor task batteries, including various vigilance, tracking, digit-symbol substitution, circular light, and reaction time tasks. In general, human performance will be altered following alcohol administration, given that a sufficiently large dose is delivered (Mitchell, 1985); the degree of impairment produced by alcohol is generally related to the amount of alcohol that is administered (Evans et al., 1974; Wallgren and Barry, 1970). While consistent decrements in performance have reliably been observed when BAL's are above .10 g/dl (one commercial cocktail will increase BAL by approximately .025 g/dl in a 150 pound man), decrements in some aspects of human performance have occasionally been reported at BAL's below .05 mg/dl (Hamilton and Copeman, 1970; Moskowitz et al., 1985). Not all measures of human performance are equally sensitive to the effects of alcohol (Heishman et al., 1988). The sensitivity of any task can be altered by a number of

contextual factors, including the nature of the contingencies maintaining task performance (Bierness and Vogel-Sprott, 1984), whether BAL's are increasing or decreasing when the task is performed (Vogel-Sprott, 1979), and whether the task is performed alone or simultaneously with other tasks (Moskowitz, 1979). Alcohol's effects on human performance vary as a function of the dimension of performance being measured and contextual factors associated with the performance.

While performance is a critical dimension of workplace safety and productivity, other dimensions of human behavior, such as social behavior, are also relevant. For example, cooperation among employees, or between employees and customers is essential for successfully adapting to the complexities and challenges of the workplace. Dose-related increases in social and verbal behavior have been reported following alcohol administration in controlled settings (Griffiths et al., 1978; Higgins and Stitzer, 1988; Stitzer et al., 1981), but it remains unclear whether these effects are beneficial or detrimental to workplace productivity and safety. Disruptions of effective social interaction, such as might occur with increased aggressive behavior, have clear detrimental consequences. Few studies have examined the dose-response relationship between alcohol and social behavior, and the relevance of alcohol's effects on social behavior for the workplace are less clear than for performance measures. Since aggressive behavior has clear implications for the workplace, experimental investigations of the dose-response relationship between moderate alcohol consumption and aggressive behavior will be examined in some detail.

EXPERIMENTAL ANALYSIS OF AGGRESSIVE BEHAVIOR

Aggressive behavior has been operationally defined by experimental investigators as behavior that presents an aversive or noxious stimulus to another individual (Buss, 1961). Three laboratory procedures have been developed to investigate human aggressive behavior. The initial procedure, developed by Buss (1961), was ostensibly concerned with the effects of punishment on learning. Experimental subjects, cast as teachers, were asked to provide positive and negative feedback to another subject, cast as a "learner," during performance on a discrimination learning task. "Teachers" could illuminate signal lights following correct trials and deliver electric shocks from an array of shock intensities following errors. Subjects were informed that punishment enhanced "learner" performance in other studies. In reality, the "learners" were experimental confederates whose performances were predetermined. The selected shock intensities and the durations of shock presentation served as objective measures of aggressive behavior. A second procedure, developed by Taylor (1967), involved reaction time competition trials. Two subjects were seated in front of reaction time equipment with electrodes attached to their wrists. Sessions consisted of signaled reaction time trials. Prior to each trial, both subjects selected shock

intensities to be delivered to the other subject; however, only the subject responding less quickly on a trial received the shock. After each trial, both subjects received feedback concerning the shock intensity selected by the other subject prior to the trial. In reality, one subject was an experimental confederate whose performance was predetermined. As with the Buss procedure, the intensity of shock selected on any given trial served as an objective measure of aggressive behavior. Both procedures have been used to study aggressive behavior in a number of different subject populations and to study the effects of a range of variables, including drugs, on human aggressive behavior (Buss, 1961; Taylor and Leonard, 1983). In general, research on the effects of alcohol on human aggressive behavior, using either of these two procedures, has consistently reported increases in aggressive responding following administration of sufficiently high doses of alcohol (Pihl, 1983; Taylor and Leonard, 1983; cf. Bennett et al., 1969). A third free-operant procedure was developed by Cherek (1981) specifically to investigate the effects of drugs on human aggressive behavior. The free-operant laboratory procedure incorporated a number of techniques which allowed for more precise and selective measurement of drug effects on human aggressive behavior.

FREE-OPERANT METHODOLOGY

In the free-operant procedure, subjects were typically located in an isolated room equipped with a counter, two buttons with corresponding signal lights, and a thermistor. Immediately prior to sessions, the thermistor was attached to a subject's nondominant index finger, and skin temperature and heart rate were ostensibly monitored. Sessions typically lasted fifty minutes. During sessions, responding on the buttons produced different consequences.

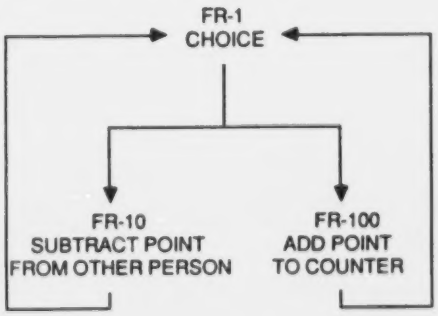

Figure 1. Free-Operant Choice Contingencies

Responding on one button earned points that were exchanged for money (10 cents per point) at the completion of a session. Points were displayed on the counter. Responding on the second button ostensively subtracted points from another research subject, depicted as participating in the same study at another location. Patterns of responding on the second button (i.e., subtracting points, or money from another participant) served as the measure of aggressive behavior.

The contingencies maintaining button pressing are displayed in figure 1. At the start of a session, subjects were presented with the option to choose between pushing a button to earn points, or pushing a button to subtract points from the other subject. If the right "earn points" button was chosen, the right signal light was illuminated. When the subject completed 100 responses on the right button, the counter increased by one and the right signal light was turned off indicating that both buttons were again available. If the left "subtract points" button was chosen, the left signal light was illuminated. When the subject completed 10 responses on the left button, a point was ostensibly subtracted from the other subject and the left signal light was turned off, indicating that the choice condition was again available. After a choice was made, and prior to completion of the response requirement on the chosen button, responses on the unchosen button were recorded, but had no programmed consequences.

Some provoking event is usually required to set the occasion for aggressive behavior (Taylor, 1967). To increase the likelihood that subjects would respond on the point-subtraction button, points previously earned by the subject were subtracted from the counter, and these point subtractions were attributed to the second subject. In reality, points were subtracted at random times during each session. Most subjects responded on the point-subtraction button immediately following occasional point subtractions during sessions, and consistent patterns of point-subtraction responding across sessions usually emerged over the first three to five sessions.

With this free-operant procedure, subjects had a point-maintained nonaggressive response option and a topographically-similar aggressive response option available throughout each session. The simultaneous measurement of topographically-similar aggressive and nonaggressive responding enabled the assessment of whether drugs had selective or differential effects on aggressive and nonaggressive behavior.

A second advantage of this procedure is that aggressive responding is not required during sessions, although the opportunity to do so is available at any time. The use of free-operant procedures produce measures of behavior that are more sensitive to drug effects than behavior generated during experimental trials (Thompson and Boren, 1977). Free-operant laboratory procedures better simulate the conditions of aggressive responding in the

natural ecology. The effects of alcohol on aggressive behavior, as measured by the free-operant procedure, will be examined below.

ALCOHOL ADMINISTRATION

Healthy adult male volunteers reporting occasional alcohol consumption gave written consent and participated for 1.5 hours per day, Monday through Friday, over six to eight weeks. Beverages, consisting of 16 ounces of ginger ale and ice, with 2 drops of peppermint oil and 1 ml of 95 percent ethyl alcohol floated on top, were administered at the start of the 1.5 hour interval, if blood alcohol levels (BAL's) were zero. Subjects were required to consume the beverage over a 20-minute interval. Thirty minutes after the beverage was administered, a fifty-minute session began. BAL's were measured immediately before and after each session.

Placebo cocktails were administered every session until stable aggressive and nonaggressive responding was observed from session to session. Once stable patterns were observed, alcohol doses between 0.12 g/kg and 0.75 g/kg were occasionally added to the beverage. Placebo sessions always occurred between successive alcohol sessions to insure that stable patterns of responding were maintained throughout the study. Doses were initially administered in an ascending sequence to increase the safety and comfort of subjects. The second exposure to doses was in a descending fashion, and the final exposure was in a random order.

RESULTS

The effects of alcohol on the aggressive responding of eight subjects is presented in figure 2 (Cherek et al., 1985). The four subjects presented in the top panel, labeled high provocation, were presented with 20 point subtractions per session, on average, and the four subjects presented in the bottom panel, labeled low provocation, were presented with five point subtractions per session, on average. Statistically significant increases were observed at the .23 and .46 doses (approximately one and two commercial cocktails). No changes in point-maintained responding were observed at any dose for these subjects. It is interesting to note the individual differences in response to alcohol administration. Large increases were observed in two subjects (S96, top panel, and S68, bottom panel), and little or no change was observed in three subjects (S78 and S88, top panel, and S61, bottom panel).

Clearly, the effects of small amounts of alcohol (i.e., one to two commercial cocktails) are sufficient to increase the probability with which humans engage in aggressive responding. These amounts of alcohol produce blood alcohol levels that are well within legal intoxication limits, and may be consumed by employees who are working under the assumption that these amounts will produce little or no change in job performance. However, to the extent that

aggressive social behavior influences workplace productivity, such assumptions may need to be reconsidered.

Modifications of the free-operant procedure have been used to study the influence of contextual factors on the relationship between alcohol and human aggressive behavior. Additional studies have been conducted to determine whether the effects of alcohol on aggressive behavior vary as a function of the situational context in which alcohol is administered.

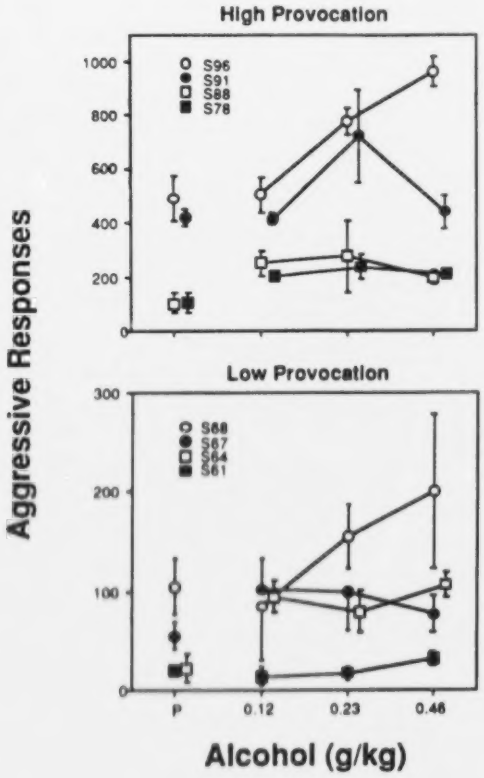

Figure 2. Aggressive Responding Following Alcohol Administration

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EFFECTS OF PROVOCATION CONDITIONS

Table 1. Provocation Parameters

Component	Intensity[1]	Frequency[2]	Total[3]
1	0	0	0
2	1	3	3
3	3	1	3
4	1	6	6
5	3	2	6

[1]Mean number of point subtractions per provocation.
[2]Mean number of provocations per ten-minute interval.
[3]Mean number of point subtractions per ten-minute interval.

In one study, the effects of provocation on the relationship between alcohol and aggressive responding were evaluated (Kelly et al., 1988). Four subjects were exposed to five 10-minute components during a typical 50-minute session. Within each 10-minute component, the schedule of point subtractions was manipulated (table 1). During Component 1, no points were subtracted. During both Component 2 and 3, an average of three points was subtracted. During Component 2, one point was subtracted on three different occasions; while during Component 3, three points were subtracted on one occasion. During Components 4 an 5, six points were subtracted on average. During Component 4, one point was subtracted on six different occasions; while during Component 5, three points were subtracted on two different occasions. As in the previous study, placebo cocktails were administered until stable patterns of aggressive and nonaggressive responding were observed within each component.

Figure 3 presents aggressive responding during Components 2, 3, 4 and 5. Subjects rarely responded aggressively in the absence of point subtractions during Component 1. The number of point subtractions varied across Components 2 through 5, and aggressive behavior is presented as responses per point subtraction. During placebo sessions, subjects responded fewer times per point subtraction during Component 2 than during Components 3, 4 and 5. Aggressive responses per provocation increased as a function of alcohol dose, up to 0.75 g/kg (approximately equivalent to the amount of alcohol in three commercial cocktails). However, increases were observed in Components 3, 4 and 5, only. No increases in aggressive responding were observed during Components 1 or 2.

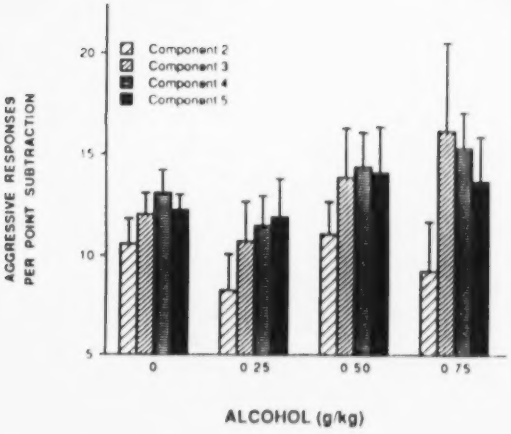

Figure 3. Effects of Alcohol on Human Aggressive Behavior Engendered By Varying Point-Subtraction Conditions

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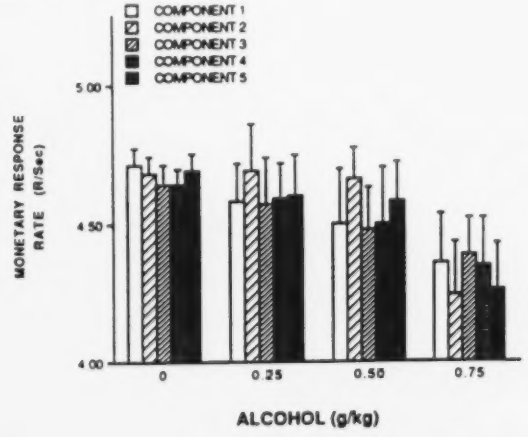

Figure 4. Effects of Alcohol on Human Point-Maintained Responding

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These data suggest that increases in aggressive responding following alcohol administration may be related to the level of provocation prior to alcohol administration. Increases in aggressive responding following alcohol administration may be more likely in situations in which provocation is frequent or intense.

Figure 4 presents point-maintained response rates during each component as a function of alcohol dose. Response rates were similar in each component, indicating that provocation manipulations had no effect on nonaggressive responding. Alcohol produced dose dependent decreases in point-maintained responding, and this effect was observed in each component. Clearly, alcohol's effects on aggressive responding were different from those on point-maintained responding. These results suggest that the aggression-increasing effects of alcohol are not the result of a non-systematic, rate-increasing effect.

EFFECTS OF CHANGES IN WORK REQUIREMENTS

In a third study, the effects of work requirements on the relationship between alcohol and aggressive responding were examined by varying the number of button presses required of subjects in order to earn points (Kelly et al., 1989). Subjects were exposed to three different components during each session. In this study, the schedule of point subtractions remained constant across components, while the number of responses required for point presentation were varied. During one component, 50 responses were required per point presentation. During the other two components, 200 or 500 responses were required per point presentation. Components were presented in random order twice per session, and each component was presented once before any component occurred a second time.

Six subjects participated in the study. The aggressive responses per point subtraction of each subject are presented in figure 5. Diamonds represent the low-work components (50 responses per point), circles represent the medium work components (200 responses per point), and squares represent the high work components (500 responses per point). On placebo sessions, aggressive responding was directly related to work requirements during components. Low doses (.12 g/kg, .25 g/kg) had no effect on or decreased aggressive responding by subjects. The high dose (.5 g/kg) produced significant increases in aggressive responding, and a significant interaction between alcohol dose and work requirements was observed. In four subjects, substantial increases in aggressive responding were observed during the high work-requirement component (500 responses per point). The effects were less dramatic in the lower work-requirement components. Two subjects (V-79 and V-114) exhibited no change in aggressive responding as a function of alcohol dose.

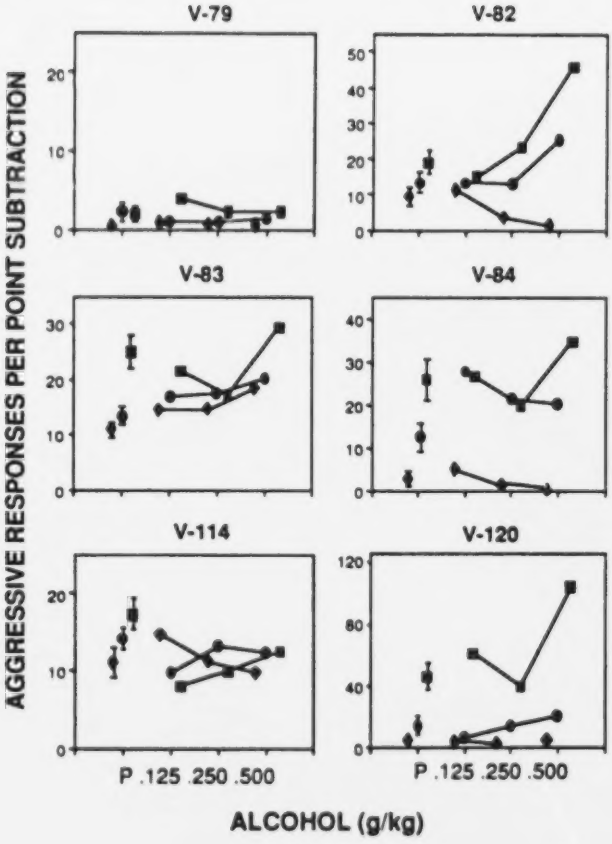

Figure 5. Effects of Alcohol on Human Aggressive Behavior During Three Concurrent Schedules of Point Presentation

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Table 2. Breath Alcohol Levels (g/dl) Measured Immediately Before and After Experimental Sessions

Subject	Dose(g/kg)	Before	After
V-79	.125	.00	.00
	.250	.30	.10
	.500	.80	.40
V-82	.125	.10	.00
	.250	.30	.10
	.500	.70	.50
V-83	.125	.00	.00
	.250	.10	.00
	.500	.40	.20
V-84	.125	.00	.00
	.250	.30	.10
	.500	.70	.50
V-114	.125	.10	.00
	.250	.40	.20
	.500	1.10	.70
V-120	.125	.20	.00
	.250	.70	.10
	.500	.80	.50

The individual subject differences did not appear to be related to blood alcohol levels. Table 2 presents blood alcohol levels prior to and following alcohol sessions. Subject V-114, who showed little change in aggressive responding following alcohol administration, exhibited the greatest increases in blood alcohol levels, and the blood alcohol levels of the other non-responder (V-79) were not different from the other four subjects.

These data suggest that increases in aggressive responding following alcohol administration may also be related to ongoing work requirements prior to alcohol administration. Alcohol may produce greater than usual effects on aggressive responding when work requirements, or the amount of effort required from employees, are temporarily increased.

The effects of alcohol on point-maintained responding are presented in figure 6. Again, no changes or dose-related decreases in point-maintained responding were observed, indicating that alcohol's effects on aggressive behavior are not related to any general systemic effects.

These results clearly indicate that alcohol consumption alters the probability with which humans engage in aggressive behavior, and that alcohol's effects on aggressive behavior are influenced by the environmental context in which

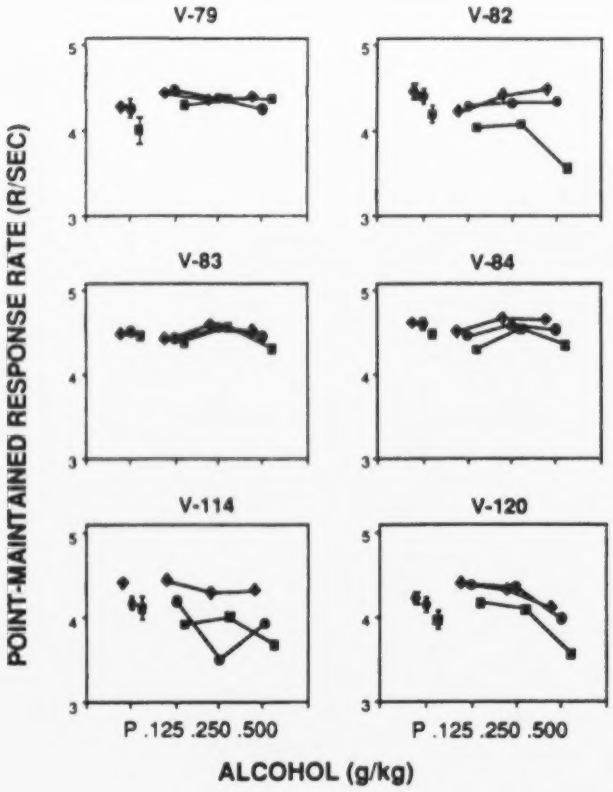

Figure 6. Effects of Alcohol on Human Responding Maintained During Three Fixed-Ratio Schedules of Point Presentation

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alcohol is administered. The specific dimensions of the environmental context that are related to these differential results remain speculative, but provocation conditions and work requirements may be two factors that are involved. Additional research is required to clarify the status of these variables. The results also indicate that individual subjects exhibit variability in response to alcohol. This result has been observed in studies of alcohol's effects on measures of performance, as well. Several factors, including experience with alcohol, tolerance, and biological differences across individuals, contribute to inter-subject variability in response to a given dose of alcohol.

As with task performance measures, the effects of alcohol on human social behavior are dependent on the dimension of social behavior being monitored, as well as on the contextual factors under which the alcohol is administered. These results indicate that moderate alcohol consumption can influence the workplace by disrupting worker performance and by altering social behavior. Given that the effects of alcohol are related to both the dimensions of behavior being monitored, as well as the contextual factors under which alcohol is administered, descriptions of the potential influence of alcohol in any specific workplace site must take into account the work requirements and contextual factors present at a given work site.

CONCLUSION

Chronic alcohol consumption exerts a dramatic economic and social influence on the workplace. Less well described, but also important, is the influence of occasional, moderate alcohol consumption on workplace safety and productivity. Occasional, moderate alcohol consumption is substantially more prevalent in full-time employees than is heavy, chronic use (i.e., more than 5 drinks per day). Moderate alcohol users, on occasion, consume alcohol on the job, and recent evidence suggests that intermittent heavy alcohol use by moderate alcohol consumers may result in changes in performance even after BAL's have returned to zero (i.e., "hangover" effects). As such, moderate alcohol use may influence workplace performance. Laboratory studies clearly indicate that the amount of alcohol in even a single commercial cocktail affects performance and social behaviors that are relevant to workplace performance. As such, descriptions of the effects of alcohol in the workplace must include considerations of occasional, moderate alcohol use by employees. Contextual factors are also important in determining alcohol's effects on human behavior, and other drugs, such as marijuana and amphetamine (Fischman et al., this volume), as well. It is clear that a comprehensive account of the effects of drugs in the workplace would benefit from investigations of alcohol and other drug effects on dimensions of human behavior that are relevant to workplace safety and performance, conducted in controlled laboratories that can simulate workplace environmental contexts.

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Impact of Moderate Alcohol Consumption on Business Decision Making

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INTRODUCTION

This study investigates the effect of moderate alcohol consumption on learning and the execution of a business decision making task. Decision making was evaluated within the framework of Steele and Southwick's inhibitory response conflict model. Subjects were randomly assigned to one of four cells of a balanced placebo design: they expected and received alcohol, they expected alcohol but received tonic, they expected tonic but received alcohol, or they expected and received tonic. Within these conditions, subjects were trained to participate in a business decision making simulation and then to make three successive pricing and ordering decisions. Subjects who consumed a moderate amount of alcohol scored significantly poorer on a short test of recall. Moderate alcohol consumption combined with high inhibitory response conflict (IRC) led to extreme changes in decisions made. Significant expectancy effects were also found. Theoretical and practical implications of these findings are discussed.

Social drinking is considered an acceptable part of the business environment. Business lunches are often accompanied by a cocktail, a glass of wine or a beer. After-hours meetings or dinners often begin with libations to facilitate conversation and to ease the tensions of the day. Alcohol is known to promote affability, even back-slapping friendliness (Pernanen, 1976).

Not only has social drinking been regarded as acceptable, it is generally regarded as facilitative rather than as detrimental to subsequent business decisions and actions of social drinkers. Yet, alcohol has been found to impair one's ability to: (1) foresee the negative consequences of a response,

(2) access inhibiting standards of conduct, and (3) perceive peripheral inhibiting cues (Pernanen, 1976; Zeicher and Pihl, 1979; Hull et al., 1983).

These impairments could, conceivably, compromise decision making in a business setting, mitigating perceived benefits of alcohol consumption.

Many effects of alcohol in the workplace are still not known. Although extensive documentation shows that alcohol impairs perceptual-cognitive functioning (Kastl, 1969; Tarter et al., 1971) and the ability to derive meaning from incoming information (Birnbaum et al., 1980), the literature is silent concerning effects of social drinking on managerial effectiveness. Available studies deal mainly with the etiology of alcoholism in professionals.

This study tests the effects of moderate alcohol consumption--consumption which approximates that of the one or two-martini lunch--on subjects' ability to recall newly learned information pertaining to a typical set of business decisions, and on subjects' actual performance in a simulated business setting.

MODERATE ALCOHOL CONSUMPTION AND RECALL: HYPOTHESIS 1

Alcohol consumption reduces individual ability to perform cognitive tasks. Subjects experience reduced problem solving ability, (Marlatt and Rohsenow, 1980; Parsons and Leber, 1982; Parker, 1982; Parsons and Fabian, 1982), reduced ability to encode a large number of situational cues (Washburne, 1956), and reduced ability to use several cues simultaneously (Moskowitz and De Pry, 1968; Medina, 1970).

Managerial decision making relies directly on such cognitive skills as the ability to conceptualize, abstract, make judgement calls, remember details, and to discriminate important from irrelevant information (Katz and Kahn, 1977; Stogdill, 1974; Mann, 1965). Conceivably, the consumption of a moderate amount of alcohol, as one might drink during a business lunch or cocktail party with prospective clients, might impair individual ability to recall newly learned information which could adversely affect subsequent business decisions. The pharmacological effect of alcohol which compromises simple recall suggests that:

> **Hypothesis 1**--Subjects who consume a moderate amount of alcohol will be less able to recall details of newly presented information pertaining to business decision tasks than will subjects who do not consume alcohol.

MODERATE ALCOHOL CONSUMPTION AND INHIBITORY RESPONSE CONFLICT (IRC): HYPOTHESES 2 AND 3

Sober subjects who are provoked tend to use inhibitory cues and contingencies to regulate and moderate behavior, whereas intoxicated subjects tend to plunge ahead with more aggressive behavior regardless of inhibitory cues (Zeichner and Pihl, 1979; Zeichner and Pihl, 1980; Pihl et al., 1981). Intoxicated subjects have difficulty processing information pertinent to the consequences of behavior (Zeichner and Pihl, 1979). Hull, Levenson, Young and Sher (1983) reported that alcohol reduces self-awareness--an impairment which contributes to weakening of inhibitions, and leads to more aggressive, socially unacceptable behavior.

The relaxation of inhibitions as a result of alcohol consumption can have a profound effect upon behavior when an individual is experiencing inhibitory response conflict (IRC). The term "inhibitory response conflict" was coined to define the simultaneous arousal of incompatible response tendencies (Steele and Southwick, 1985). IRC describes a condition where a response tendency instigated by one set of cues (internal or external) is opposed by a tendency to inhibit the response because of other cues (also internal or external).

An example of appropriately inhibited behavior, when experiencing the effect of high IRC, can be seen in the decision of a gambler to quit after a predetermined limit of losses has been reached; the decision of an obese person on a diet to refrain from eating a banana split; and the decision to not engage in fisticuffs with a bully twice one's size. However, under the influence of alcohol, the drinker experiencing high IRC is unable to process appropriate inhibitory cues: the gambler keeps gambling (despite his/her limit); the dieter eats the banana split (despite the need to reduce caloric intake); and the individual being antagonized takes on the bully despite being half the antagonist's size.

Like the gambler who decides to keep gambling in the face of inhibitory cues to quit, the business decision maker experiencing high IRC may proceed with high risk decisions while under the influence of alcohol despite inhibitory cues which suggest the need to proceed cautiously (e.g., past experience suggesting that attempts to increase sales by 50 percent in one month will probably result in further losses). High IRC in a business setting occurs when a business decision maker is faced with instigatory pressures such as the need to recoup business losses or to correct poor past decisions and is also faced with strong inhibitory cues, such as the need to avoid further losses because of hasty or unwise decisions. Under such circumstances, moderate alcohol consumption could impede the drinker's capacity to retrieve and to use appropriate inhibitory cues, leading to higher risk decision making.

It has been suggested that moderate alcohol consumption *together* with a high IRC condition are required to cause riskier decision making (Steele and Southwick, 1985; and Steele et al., 1985). Under a low IRC condition, the effect of alcohol on inhibitions is not an issue. When inhibitory cues are not pushed by equally strong instigatory pressures, or if the decision maker does not feel instigatory pressures at all, decisions tend to be less risky.

We believe that once high IRC conditions are established in a competitive, simulated business setting that:

> **Hypothesis 2**--High IRC subjects who expect and consume a moderate amount of alcohol will make riskier business decisions than will high IRC subjects who expect and consume only tonic.
>
> **Hypothesis 3**--High IRC subjects who expect and consume a moderate amount of alcohol will make riskier business decisions than will low IRC subjects who expect and consume a moderate amount of alcohol.

EXPECTANCY EFFECT AND MODERATE ALCOHOL CONSUMPTION: HYPOTHESES 4 AND 5

Drinking expectancies--belief that one is consuming alcohol independent of actual consumption--may also lead to risky decision making under a high IRC condition. The belief that one is consuming alcohol (regardless of actual consumption) may play a role in reducing inhibitions that affect business decision making. Steele and Southwick (1985) found that expectancy was unrelated to IRC. This finding suggests that it is the pharmacological effect of alcohol, rather than the belief that one is drinking alcohol, which reduces inhibition. An extension of this perspective posits that the pharmacological properties of alcohol have more of an effect upon decision making than does the social setting in which alcohol is imbibed. Consequently we hypothesize that:

> **Hypothesis 4**--Subjects experiencing high IRC who expect and consume a moderate amount of alcohol will make riskier decisions, than will high IRC subjects who expect alcohol but instead consume tonic.
>
> **Hypothesis 5**--Subjects experiencing high IRC who expect and consume tonic will make less risky decisions, than will high IRC subjects who expect tonic but instead consume alcohol.

METHODS

Subjects

Forty males and 40 females participated in the study. Subjects were drawn from the psychology department subject pool and from respondents to advertisements placed in the University newspaper. Subject pool respondents received credit for a 2.5 hour experiment; other respondents were paid five dollars for their participation.

One day before the experiment, potential subjects completed a biographical information questionnaire, the Drinking Habits Questionnaire (Calahan et al., 1969), and the Michigan Alcohol Screening Test in order to check for signs of alcohol dependency. Subjects were told not to eat or drink for four hours prior to the scheduled experiment.

Participation was limited to light to moderate drinkers above the age of 21 who reported no signs of alcohol dependency. Participating men were somewhat younger than the women (males, $x = 22.7$; women, $x = 25.9$, $F = 7.45$, 1.79 d.f., p .01). All subjects reported for the experiment as scheduled.

On arrival at the lab, subjects were weighed, their picture identification checked, and an initial breathalyzer reading taken to insure they had not been drinking alcohol. All subjects signed an informed consent form which described the nature of the experiment and possible risks. Females were asked to verify that they were not pregnant, and all subjects were required to verify that they had no pre-existing conditions that would precipitate a negative reaction to alcohol.

Design

Marlatt and Rohsenow's (1980) balanced placebo design was used in this study. Subjects were assigned to same-sex foursomes in which each subject represented a different experimental group. Assignments to experimental conditions were made by coin toss. Subjects were informed that one side of the table was randomly assigned to receive alcohol, and the other side a non-alcohol beverage (tonic). In fact, in each foursome, expectancy (expect alcohol; expect tonic) was crossed with actual beverage consumed (get alcohol; get tonic). One subject expected alcohol, but got only tonic (EAGT); one subject expected, and got alcohol (EAGA); one subject expected only tonic, but got alcohol (ETGA); and one subject expected and got tonic (ETGT).

Drink Administration--Subjects in EAGA and ETGA conditions received 1.88 milliliters of 80-proof vodka per kilogram of body weight--an amount of alcohol sufficient to bring subject blood alcohol levels (BAL) to .06. This BAL is below the level legally defined as intoxicated in the state of Washington (BAL of .10), and is equivalent to alcohol consumption typical in a social setting, where one or two drinks would be consumed.

Drinks were mixed according to Marlatt and Rohsenow's procedure (1980). Vodka bottles were prefilled either with a pre-mixed vodka and tonic mixture (1:5 vodka to tonic), or with flat tonic. The two vodka bottles (one containing vodka and tonic and one containing tonic), and tonic bottles (some containing vodka and tonic, others carbonated tonic) were brought to the experiment room in a tub filled with ice. To facilitate deception, an assistant mixed beverages in full view of subjects.

Subjects were required to consume beverages within 14 minutes; empty glasses were removed immediately thereafter. Fifteen minutes later, BAL readings were taken, recorded, and reported to subjects. Subjects who were being deceived were provided with false readings appropriate to their condition.

Experimental Tasks

Subjects sat two across a large conference table. At each place were pencils, blank paper, calculators, and a sheet with information pertaining to the decision task.

While consuming beverages, subjects received training on how to make pricing and ordering decisions for "fancy donuts" sold by their donut store (from *The Donut Franchise: A Microcomputer Simulation* published by McGraw-Hill, Lewis and Lewis). Each subject was assigned to one of four competing donut stores. Training sessions were conducted by one of the authors of the simulation. Subjects were encouraged to make optimum pricing and ordering decisions in order to maximize profits, and were informed that "missed sales" and "excess inventory" were indicators of poor past decisions which reduced profits. Subjects were also cautioned to make conservative decisions because radical decision making could accelerate losses.

Immediately following training (which coincided with taking of BALs), subjects were asked to turn their notes over and to take a short 10-item quiz (within ten minutes) over material presented during training. As soon as quizzes were collected, subjects were given 15 minutes to make pricing and ordering decisions for "fancy donuts" for the first decision period. Subjects were not allowed to speak to each other while making their decisions or during any other part of the experiment.

After decision forms for the first decision period were collected, subjects rated the decisions just made on the basis of the amount of risk they felt they had taken with regard to the prices charged and quantity of doughnuts ordered (overall risk), and the extent to which the competitive nature of the task contributed to making of risky decisions. They then engaged in a filler task. New management reports were generated after computer processing for the next round of pricing and ordering decisions. (Management reports included a simple income statement for the month showing sales, expenses and profits, and a report of "missed sales" and "excess inventory.")

Subjects then made pricing and ordering decisions for the second and third decision periods, each time rating perceived risk of decisions at the conclusion of each decision period.

Experimental trials concluded with the administration of a post-test questionnaire. Subjects were then given a final, accurate BAL reading and were fully debriefed. Two subjects were given rides home because their BALs still exceeded .05.

Establishing IRC--Experimental conditions created IRC in some subjects, but not in others. "Missed sales" and "excess inventory" are independent. Subjects could not incur both conditions at the same time; therefore, a median was calculated for each distribution, and high IRC was defined as occurring when subjects' missed sales or excess inventory exceeded the respective median of either distribution, and low IRC when the total of missed sales or excess inventory was below the respective median.

Subjects above the median of either distribution were under instigatory pressure to improve performance during future decision periods (they had been trained to recognize either situation as problematic and requiring change). At the same time, they were also subject to inhibitory pressure because of cautions received during training.

Analyses

Our primary analysis was a 2 X 2 X 2 factorial analysis of variance comparing two levels of actual beverage consumption (alcohol, tonic); two levels of expectancy (expect alcohol, expect tonic); and two levels of IRC (high, low). IRC was not part of the predictor for Hypothesis 1 (concerning recall) and, therefore, was not included as a factor in the testing of this hypothesis.

Unweighted means analyses (Horst and Edwards, 1982) were conducted because of unequal cell sizes which occurred because two groups (one group of men and one of women) failed to complete the third decision trial. These

analyses were conducted on the dependent measures quiz scores (for Hypothesis 1); and absolute changes in pricing strategy between decision periods 1 and 2 (price change 1); between decision periods 2 and 3 (price change 2); and the absolute change in quantity of product ordered between decision periods 1 and 2 (quantity change 1); and between decision periods 2 and 3 (quantity change 2).

RESULTS

Manipulation Check of Deception

An analysis of the post-test questionnaire items indicated that all deceptions were not wholly successful. Subjects who actually consumed alcohol reported feeling higher levels of intoxication than did those who actually consumed only tonic ($F = 18.38$, 1, 76 d.f., p .001).

Scale averages and standard deviations by group are shown in table 1. The scale ranged from 1 (very sober) to 7 (very intoxicated).

Table 1. Reported Levels of Intoxication Immediately After the Experiment.

Group	n	mean	SD
EAGA	20	2.50	1.63
EAGT	20	1.55	.998
ETGA	20	3.15	1.56
ETGT	20	1.45	1.15

Another question concerned whether or not subjects felt deception had occurred (simple yes or no format). A significant F value indicated that the groups differed in their perception of whether or not deception had occurred ($F = 3.0$, 1,76 d.f., p .035, see table 2). However, subjects were also asked to report which beverage they had consumed. Interestingly, subjects reported that they had actually consumed the beverage they had been assigned ($F = 33.49$, d.f. 1, 76, p .001, table 3).

Table 2. Respondent Beliefs That Deception Was (1) or Was Not (0) Used During the Experiment.

Group	n	mean	SD
EAGA	20	.316	.48
EAGT	20	.263	.45
ETGA	20	.684	.48
ETGT	20	.368	.50

Table 3. Scale Averages and Standard Deviations Indicating What Beverage Subjects Said That They Consumed. Responses Coded 0 (Tonic Only) or 1 (Vodka and Tonic).

Group	n	mean	SD
EAGA	20	.894	.32
EAGT	20	.944	.24
ETGA	20	.300	.47
ETGT	20	.053	.23

To summarize, the ETGA group may have been less "fooled" by the deception relative to other groups. The length of the experiment (two and one half hours) may have made it difficult to maintain the deception. Over time, ETGA subjects may have become aware of their mild intoxication. However, it is not clear how this awareness influenced performance: the second manipulation check indicated that subjects appeared to be deceived because they tended to report consuming the beverage they were assigned (table 3).

Manipulation Check Of IRC

Responses of those categorized in high versus low IRC groups were compared on the decision risk-assessment measures (subjects' perceived risk and competitiveness) in order to check validity of assignments to high and low IRC conditions. A Student's t-test determined that the average rating of overall risk ("I felt that my decision was..." extremely conservative (coded 1);

extremely risky (coded 9)) was significantly higher after the first decision period for high IRC subjects than for low IRC subjects (t = -2.73, 78 d.f., p .01).

After the second decision period, the assessment of overall risk was not significantly different between low and high IRC subjects. However, on a scale which assessed risk due to the competitive nature of the task, decisions of high IRC subjects were more extreme than those of low IRC subjects (t = -2.2, 73 d.f., p .05). The second scale stated "The competitive nature of this task caused me to be ... than I would be under normal circumstances." Responses ranged from "much more conservative"> (coded 1) to "much more risky" (coded 7).

Other researchers (Steele et al., 1985) tested manipulation of instigatory pressures, but not inhibitory pressures as we did, using only one manipulation check. This study used two manipulation checks and repeated these measures over time. Although after the third decision period, ratings were no longer significantly different between high or low IRC subjects, the nature of perceived risk did change in a meaningful way during experimental trials; there was a significant difference between low and high IRC subjects on the manipulation check measures.

Test of Hypothesis 1

The first hypothesis predicted that moderate alcohol consumption would interfere with recall of newly learned information pertaining to a set of business decisions. The results of a 2 X 2 factorial analysis of variance which crossed actual alcohol consumption with two levels of expectancy showed a significant main effect for actual beverage (F = 23.51, d.f. 1, 76, p .001, table 4). Means and standard deviations of quiz scores show that subjects who consumed a moderate amount of alcohol were significantly impaired (table 5).

Table 4. Analysis of Quiz Scores Comparing Expected Beverage Conditions, Actual Beverage Conditions, and the Interaction of Expectancy X Actual Beverage Assignment.

Source	SS	DF	MS	F
Total	3354.05	79		
Expectancy	.80	1	.80	NS
Actual beverage	51.20	1	51.20	23.51[1]
Interaction	.2244	1	.224	
Error	164.51	76	2.165	

[1] $p << .001$

Table 5. Average Quiz Scores and Standard Deviations by Group.

Group	n	mean	SD
EAGA	20	5.70	2.40
EAGT	20	7.45	1.35
ETGA	20	5.65	1.31
ETGT	20	7.10	1.62

Results of 2 X 2 X 2 Factorial Analysis of Variance

Hypotheses 2, 3, 4, and 5 were tested using a 2 X 2 X 2 factorial analysis of variance with contrasts as indicated. Two levels of expectancy (expect alcohol, expect tonic), two levels of actual beverage consumption (consume alcohol, consume tonic), and two levels of IRC (high, low) were analyzed across four dependent measures and yielded significant results. Tables 6 through 9 summarize results of these analyses.

The analyses based on Price Change 1 yielded significant Fs for the main effects of IRC (F = 13.09, d.f. 1, 64, p .001); expectancy (F = 5.25, d.f. 1, 64, p .025); and for the interaction between IRC and expectancy (F = 4.436, d.f. 1, 64, p .039). Price Change 2 yielded a main effect for IRC (F = 8.08, d.f. 1, 64, p .006).

Table 6. Results of Factorial Analysis of Variance Comparing Two Levels of Expectancy (Alcohol, Tonic), Two Levels of Actual Beverage Consumption (Alcohol, Tonic), and Two Levels of IRC (Low, High) on the Dependent Measure, Price Change 1 (Change in Price from the First to Second Decision Period).

Source	Sum of Squares	DF	Mean Square	F
Total	16.978	79		
IRC	2.496	1	2.496	13.09[1]
Actual Beverage	.012	1	.012	.065
Expected Beverage	1.001	1	1.001	5.248[2]
IRC x Actual	.07	1	.07	.366
IRC x Expectancy	.846	1	.8464	.436
Actual x Expectancy	.006	1	.006	.856
IRC x Actual x Expectancy	.244	1	.244	.262
Residual	12.207	72	.1695	

[1] p.01
[2] p.05

The analyses of Quantity Change 1 and Quantity Change 2 also yielded significant Fs for IRC (F = 7.45, d.f. 1, 64, p .01; F = 5.012 d.f. 1, 64, p .03) as tables 6 through 9 show.

Table 7. Results of Factorial Analysis of Variance Comparing Two Levels of Expectancy (Alcohol, Tonic), Two Levels of Actual Beverage Consumption (Alcohol, Tonic), and Two Levels of IRC (Low, High) on the Dependent Measure, Price Change 2 (Change in Price From the Second to Third Decision Period).

Source	Sum of Squares	DF	Mean Square	F
Total	21.614	71		
IRC	2.248	1	2.248	8.077[1]
Actual Beverage	.470	1	.470	.198
Expected Beverage	.344	1	.344	.271
IRC x Actual	.366	1	.366	1.313
IRC x Expectancy	.234	1	.234	.840
Actual x Expectancy	.056	1	.056	.201
IRC x Actual x Expectancy	.055	1	.005	.889
Residual	17.816	64	.278	

[1] p.01

Table 8. Results of Factorial Analysis of Variance Comparing Two Levels of Expectancy (Alcohol, Tonic), Two Levels of Actual Beverage Consumption (Alcohol, Tonic), and Two Levels of IRC (Low, High) on Quantity Change 1 (Change in Quantity of Product Ordered From the First to Second Decision Period).

Source	Sum of Squares	DF	Mean Square	F
Total	1120051.5	79		
IRC	112453.45	1	112453.45	7.45[1]
Actual Beverage	2655.86	1	2655.86	.176
Expected Beverage	7089.66	1	7089.66	.495
IRC x Actual	2760.146	1	2760.146	.670
IRC x Expectancy	6555.235	1	6555.235	.512
Actual x Expectancy	9503.136	1	9503.136	.430
IRC x Actual x Expectancy	12177.391	1	12177.391	.372
Residual	965463.05	72	13409.21	

[1] p.01

Table 9. Results of Factorial Analysis of Variance Comparing Two Levels of Expectancy (Alcohol, Tonic), Two Levels of Actual Beverage Consumption (Alcohol, Tonic), and Two Levels of IRC (Low, High) on Quantity Change 2 (Change in Quantity of Product Ordered From the Second to the Third Decision Period).

Source	Sum of Squares	DF	Mean Square	F
Total	842443.605	71		
IRC	57471.409	1	57471.409	5.012[1]
Actual Beverage	12553.942	1	12553.942	1.095
Expected Beverage	1706.936	1	1706.936	.149
IRC x Actual	17794.834	1	17794.834	1.552
IRC x Expectancy	2397.873	1	2397.873	.209
Actual x Expectancy	5287.137	1	5287.137	.461
IRC x Actual x Expectancy	10595.489	1	10595.489	.924
Residual	733863.196	64	11466.612	

[1] p .05

Test of Hypothesis 2

Hypothesis 2 predicted that high IRC subjects who expected and consumed a moderate amount of alcohol would make riskier decisions than would high IRC subjects who expected and consumed only tonic. Planned comparisons conducted on each of the dependent measures confirmed the hypothesis for change in pricing strategies but not for change in quantities ordered.

The planned comparison for Price Change 1 was significant ($t = 2.52$, d.f. 1, 72, p .02), as was the planned comparison for Price Change 2 ($t = 2.22$, d.f. 1, 72, p .03).

Test of Hypothesis 3

Hypothesis 3 predicted that high IRC subjects who expected and consumed a moderate amount of alcohol would make riskier decisions than would low IRC subjects who expected and consumed alcohol. Again, planned comparisons confirmed that change in pricing strategies supported the hypothesis ($t = 2.65$, d.f. 1, 71, p .01 for Price Change 1; $t = 2.31$, d.f. 1, 71, p .02 for Price Change 2). Changes in quantity of product ordered failed to reach significance for either set of decision periods.

Test of Hypothesis 4

Steele and Southwick (1985) found that IRC was unrelated to expectancy. Alcohol's effects were found by these researchers to be due to pharmacology, rather than to expectation. Consequently, hypothesis 4 predicted significant differences in pricing decisions between high IRC subjects who expected and consumed a moderate amount of alcohol, and high IRC subjects who expected alcohol but actually received only tonic. This hypothesis was not supported by any of the planned comparisons. The means of dependent measures for the two groups shows that high IRC subjects who expected alcohol but received tonic made decisions as risky as those of their moderately intoxicated counterparts.

Test of Hypothesis 5

Again, attempting to demonstrate that IRC is unrelated to expectancy as reported by Steele and Southwick (1985), hypothesis 5 predicted that subjects who expect tonic, but instead consume a moderate amount of alcohol would, under high IRC, make riskier decisions than would subjects who experience high IRC but expect and consume only tonic. This result was confirmed for one dependent measure only--Quantity Change 2. The result was only marginally significant ($t = 1.96$, d.f. 1, 71, $p = .054$).

DISCUSSION

This study is the first of its kind to test the effects of moderate alcohol consumption on business decisions. As with many "firsts" we are left with many questions and also with several notable results.

The effect of moderate alcohol consumption on recall was an important finding. Subjects' BALs were relatively low ranging from .04 to .075 during peak intoxication. Yet, even these low BALs were sufficient to impair recall of newly learned material pertaining to a business decision task.

The literature documents the cognitive degradation alcohol causes, and demonstrates that the effects of alcohol on cognitive ability persist even after the subject is no longer intoxicated (Parker, 1982; Parsons and Fabian, 1982; Parsons and Leber, 1982). The tests used by Parsons and associates were designed to detect very subtle cognitive degradations. The present study employed a much grosser measure of recall. On both counts, findings suggest that even moderate alcohol consumption compromises recall--possibly over an extended time. Depending on the importance or complexity of information one needs to learn during a business lunch or after-hours meeting, consuming alcohol during the occasion is not advisable according to results reported here and elsewhere (Parson and Leber, 1982).

Hypotheses 2 and 3 were confirmed, supporting Steele and Southwick's (1985) meta-analysis results which indicated that moderate alcohol consumption combined *with* high IRC contributes to risky (i.e., highly changeable) decision making. High IRC subjects (EAGA) who consumed a moderate amount of alcohol tended to make riskier pricing decisions over time, than did high IRC subjects who did not consume alcohol (ETGT), and low IRC subjects (EAGA) who did consume alcohol. The only exceptions to this finding were subjects in the expect alcohol, receive tonic (EAGT) condition who were profoundly influenced by an expectancy effect.

Tests of Hypotheses 2 and 3 suggest that the one- or two-martini lunch, or the occasional drink from a bottle in the desk drawer, interferes with decision making primarily when decision makers are experiencing high IRC. Ironically, having a drink to relax before or during difficult deliberations caused by poor past decisions could significantly contribute to making future risky decisions. In this regard, it is important to emphasize that the present study examined effects of appropriate social drinking upon business decision making.

A question of concern is why the change in price yielded significant results when changes in quantity ordered, for the most part, did not. One reason may be that changing price is a more salient and familiar cue with which moderately intoxicated subjects could relate. (The management report

displayed competitor prices, but not the quantity ordered). Consequently, changing an order measured in dozens of donuts may have seemed more abstract, more difficult, or less important for intoxicated subjects to comprehend. The t values of Quantity Change contrasts for Hypotheses 2 and 3 did approach significance (probability levels ranged from .058 to .09).

The results of this study deviated from Steele and Southwick's model when expectancy effects were tested. Subjects in the expect alcohol but get tonic condition (EAGT) were well deceived by the experimental manipulation and made decisions as risky as those of their moderately intoxicated counterparts. Though inconsistent with Steele and Southwick, this finding is consistent with results reported by Marlatt and Rohsenow (1980) and confirms their contention that the environment in which one drinks provides cues which facilitate an "alcohol effect" independent of actual consumption. The setting in which business decision makers consume alcohol (e.g., a "free-wheeling," after hours cocktail party), to the extent it contributes to expectancy effects associated with consuming alcohol, may have a bearing on decision making independent of pharmacological effects. Further testing will tell.

A weakness of this study is the relatively small sample size. Although 10 subjects per cell is considered adequate for the tests of significance used here, the variability of the measures and random nature of our IRC measure is problematic and would be improved by increasing sample size and by manipulating IRC.

Also, it is conceivable that the face-to-face competitive environment subjects experienced in this study affected results. Steele, Critchlow, and Liu (1985) ran subjects individually. Subjects in the present study were run in foursomes with the experimenter and/or assistant in the room at all times. Although subjects were not allowed to speak, move about the room, or communicate with each other in writing, the group atmosphere of the present study may have provided nonverbal cues which affected subsequent decision-making behaviors. Further testing and comparison of settings is necessary to determine the generalizability of the IRC model to individuals' behaviors in nominal groups versus in relative isolation.

The greatest value of this study probably lies in its demonstration that Steele and Southwick's model, as it pertains to IRC, can help researchers and practitioners to better understand conditions in which alcohol consumption could be a threat to effective decision making. More work needs to be done to better isolate, quantify, and qualify measures of IRC. For example, a replication of the present study in which the computer algorithm gives false feedback regarding decision effectiveness and, thus, truly manipulates IRC would contribute to a better understanding of this construct.

The effects of alcohol on managerial decision making in the workplace is an important area for future study. Whether determining the effect of alcohol on cognitive functioning, or its effect on disinhibition when individuals experience high IRC, the potential for understanding and improving workplace effectiveness can only be aided by better understanding alcohol's potent but subtle effects.

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Application of Human Laboratory Data for the Assessment of Performance in Workplace Settings: Practical and Theoretical Considerations

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INTRODUCTION

Basic researchers have known for a long time that psychoactive drugs alter a person's mood as well as their ability to perform various tasks. Because of increasing trends in drug use and abuse throughout society over the past decade, employers have become concerned about drugs in the workplace and the potential for onsite drug-related accidents and impaired job performance. Only recently have researchers and employers begun to discuss together the issue of drug effects on performance. The purpose of this chapter is to further that dialogue by presenting some thoughts on what laboratory studies can offer employers or companies interested in workplace performance testing. The discussion will be centered around the following questions:

- Why should we test for drug effects on performance?
- What is performance?
- What aspects of performance should be tested?
- How do drugs affect performance?
- How do we test drug effects on performance?
- Who is affected by psychoactive drugs?
- When should we test for drug effects on performance?
- Where do we test for drug effects on performance?

DISCUSSION

Why Should We Test for Drug Effects on Performance?

The reasons for testing for drug effects on performance can be divided into two categories: basic and applied research issues. Central to an understanding of drug abuse and its treatment is a complete knowledge of the behavioral mechanisms underlying a drug's effect. This basic question has been the focus of research by behavioral pharmacologists for many decades. We know that a drug's actions are fully manifested only when an organism is interacting with its environment, which involves antecedent stimuli and consequences for all behaviors. This theoretical notion is particularly relevant when attempting to test for drug-induced performance changes in a workplace setting. Other information that basic research can provide are the time course of a drug's effect, including acute and residual effects, and a complete profile of drug action, including physiological, subjective, and performance effects.

Physiological, biochemical, or subjective correlates of drug-induced impairment can provide important predictive information in the absence of direct performance effects. Laboratory studies can also compare effect profiles across drugs to assess differences and similarities in terms of performance effects. For example, alcohol may severely disrupt performance of a task that marijuana only slightly affects. Finally, laboratory research can effectively examine mechanisms underlying drug interactions, which are critically needed in this era of polydrug abuse.

The overall applied research goal is the development of an onsite performance assessment battery that could be used to screen for drug effects. One of the primary considerations in this effort is matching the performance battery to the actual work demands of the job. Because of the wide range of skills within and across jobs, this matching task is complex, yet critical for a meaningful assessment battery. Other practical concerns, which will be discussed later, involve whether the assessment battery is valid, reliable, sensitive, or practical to implement. Broader applied issues involve the loss of job effectiveness due to drug use, drug-related accidents on the job, and the heavy toll in human lives that results from public and private transportation accidents each year. These issues are undoubtedly in the minds of basic researchers as they develop laboratory models of performance skills; however, we need input from employers and institutes tracking these real-world issues in order to effectively incorporate them into assessment batteries.

What Is Performance?

Given that it is important to test for drug effects on performance (for many different reasons), the question of what do we test becomes critical. In various situations and times, performance has been defined in terms of physical strength, sensory or perceptual ability, motor ability, psychomotor skills, ability to learn a new task, memory, or decision making skills. Obviously, none of these definitions alone fully encompass human performance, yet they all cannot be included in a single assessment battery. Thus, it becomes necessary to select one or two aspects of performance that most closely models the particular onsite work requirement. Again, the importance of matching the performance assessment battery to the workplace becomes evident.

What Aspects of Performance Should Be Tested?

To accomplish this matching of the assessment battery to the workplace requires knowing what aspect of performance various tests measure or are thought to measure. Table 1 presents the aspects of performance listed in the previous section and some laboratory tasks commonly used to measure these components.

Table 1. Components of Human Performance and Specific Laboratory Tests

Performance Component	Laboratory Test
Physical strength	Grip strength
Sensory/perceptual ability	Critical flicker fusion Auditory threshold Stimulus detection
Motor ability	Balance, Finger Tapping
Psychomotor skill	Circular lights Digit-symbol substitution Pursuit tracking
Learning	Repeated acquisition Matching to sample
Memory	Digit span Delayed recognition
Decision making	Logical reasoning

Obviously, this is not an exhaustive list, but it does indicate that there are a number of laboratory models for assessing different aspects of human performance.

Related to the question of selecting the appropriate laboratory task are the issues of validity, reliability, sensitivity, practicality, and generality of the test. These issues can be universally applied to all measurement instruments and, if satisfied, provide the basis for a useful assessment tool. Laboratory tests designed to measure the presence or absence of drug in urine or other bodily fluids are also faced with similar issues. Validity, in its broadest definition, refers to whether the test is measuring what it is intended to measure. For example, we can be fairly confident that critical flicker fusion is a valid measure of visual acuity, whereas a logical reasoning task may not be a completely valid measure of decision making ability.

A test is reliable if it produces consistent results over time. Thus, an unimpaired person should score about the same during repeated practice trials of a reliable test. A useful test must be sensitive enough to detect a drug effect, if one is present, and to show varying degrees of an effect, such as a dose-response function. On the other hand, a test that is too sensitive, yielding an effect when an insignificant amount of drug has been ingested, will be useless in meaningfully predicting impairment.

A test should also be designed so that it can be administered in a practical manner, whether in the laboratory or the workplace. A practical onsite test should be easily administered (computer or paper and pencil), of relatively short duration, involve simple, straightforward instructions, and require minimal practice for optimal performance. Finally, the results of a useful laboratory test should generalize to the performance demands of the workplace. Here, again, the issue of matching the performance assessment with the components of the actual work requirement is a central concern.

How Do Drugs Affect Performance?

Psychoactive drugs affect behavior or performance either directly through the central nervous system or indirectly through their interaction with other behavioral systems or the environment. Ultimately, all drug-induced performance impairment is mediated through brain mechanisms. The cerebral cortex is composed of three major functional areas: sensory cortex, motor cortex, and association cortex. Thus, we conveniently categorize direct drug effects on performance in terms of impairment of sensory, motor, or associative (cognitive) abilities. No drug affects only one of these cortical areas, which implies that a complete understanding of a drug's effect requires the use of several tests, assessing various aspects of performance.

Indirectly, drugs can impair performance through at least three mechanisms. First, drugs may reduce a person's motivation to perform well. Because drugs can function as reinforcers, a drug may increase the relative reinforcing effect of an alternative behavior (e.g., talking with a co-worker or daydreaming), and thus task performance declines. Secondly, drugs can function as discriminative stimuli, which serve to signal the person to behave in a certain way. Thus, drugs can set the occasion for inappropriate behavior, which results in impaired job performance. Thirdly, drug-induced impairment of performance can be interpreted in terms of state-dependent learning. This concept states that performance of a task learned under one set of environmental conditions can be altered by testing performance in a different setting. Thus, drugs can indirectly impair performance by altering the environmental stimuli under which the task was originally learned.

How Do We Test Drug Effects on Performance?

Essentially, there are two ways to test for drug effects on performance: (1) administer the drug, either acutely or chronically, or (2) deprive a person of a drug on which they are dependent and observe either short-term or long-term abstinence responses. The vast majority of human performance studies have involved acute drug administration, usually testing multiple drug doses. Typically, such studies have followed the time course of drug effects for several hours or until responses have returned to baseline levels. Few studies have investigated the effects of prolonged or chronic administration of drugs on performance. Additionally, few human studies have focused on the more subtle impairing effects of drug abstinence, which probably are more frequently encountered in the workplace than instances of obvious drug intoxication. Most studies concerned with the effects of drug deprivation have focused on effects over several hours, rather than long-term abstinence effects, although many abstinence effects are known to be protracted in nature.

A final comment regarding testing for drug effects is that assessment batteries should not be confined to performance tasks. Rather, a complete drug effect profile should be the goal. This can be accomplished by constructing assessment batteries that include a wide range of measures, including subjective, physiological, biochemical, and performance, which provide potential correlates of drug-induced performance decrements.

Who Is Affected By Psychoactive Drugs?

Obviously, everyone can be affected by psychoactive drugs; however, not everyone is affected similarly. One factor that greatly determines the nature and extent of a drug's effect is whether the person is physically dependent on

or tolerant to the drug. In terms of the two approaches to assess drug effects discussed in the previous section, physically dependent and/or tolerant persons would exhibit a relatively small drug effect in an acute drug administration paradigm, but would show a profound response in a drug deprivation study. The opposite would be true of a nondependent, nontolerant individual. Individuals with medical needs would also be expected to respond differently to a drug. For example, the person self-administering morphine for the relief of clinical pain would probably experience the drug effects differently than the person injecting morphine for its euphoric effects. Finally, a person's age may influence their response to a drug. Most human studies involve adults in the age range of 21-45. Thus, we have little information about drug effects in infants, teenagers, and the elderly, all of whom may be more or less sensitive to drugs than healthy, middle-aged adults. That drug use generally begins in the early teen years, and the disproportionate number of drug-related car accidents among teenagers and young adults, suggest that this age group may be especially sensitive to the effects of drugs. The tragic problems of infant addiction and multiple prescription drug use among the elderly are just now beginning to be investigated fully.

When Should We Test for Drug Effects on Performance?

This question has implications for both laboratory and workplace testing situations. By charting the complete time course of a drug's effect in the laboratory, we can determine the time to maximal effect and when effects have dissipated (are no longer measurable). It is also possible to measure any residual drug effects by testing several hours or days after drug administration. By simultaneously taking blood samples, the important relationship between plasma levels of the drug and performance impairment can be determined. All of this information is potentially important for onsite testing purposes. The lack of any drug-related performance impairment may simply be a function of the pharmacokinetics and/or metabolism of the drug.

These are practical considerations for onsite testing; however, there are broader issues regarding when to test for drug effects on performance in the workplace. These concern when in a person's course of involvement with a drug should performance assessment be instituted. Should everyone be tested every day? Should performance testing be started after an initial consultation with the EAP officer, after a job-related accident occurs, after the employee returns to work following a detoxification treatment period? These are complex issues that should be seriously considered by all onsite testing programs.

Where Do We Test for Drug Effects on Performance?

The three arenas in which performance testing could be conducted are the laboratory, field settings, and the workplace. The ideal progression from laboratory to onsite assessment allows for basic research questions and issues such as test validity, reliability, and sensitivity to be dealt with initially. As assessment becomes more applied in the field setting and workplace, more complex, real-world variables and situations can be examined. In the controlled laboratory, computer models of performance and simulators (e.g., driving or flight), which more closely approximate the real world, can be used to assess basic questions, such as mechanisms of drug action, time course of effect, and drug interactions. Field testing, such as a driving course, adds a dimension of reality not available in the laboratory, and, as such, constitutes an important intermediate step prior to onsite testing. Performance assessment in the workplace is the most applied testing situation and few such programs currently exist. Ideally, all assessments of performance should be evaluated according to such a testing progression; however, this rarely occurs.

CONCLUSIONS

What Information Do Laboratory Studies Have To Offer Onsite Performance Assessment Efforts?

First, because of the controlled environment in which laboratory research is conducted, issues of test validity, reliability, and sensitivity can be readily assessed. More research explicitly examining these testing concepts is needed to insure that research findings concerning drug-induced performance impairment are useful and meaningful. Secondly, laboratory studies need to begin to investigate more carefully the effect of contingencies on task performance. Currently, we can only assume that weak contingencies will produce erratic performance, whereas strong contingencies may render an assessment battery insensitive to drug effects. Finally, laboratory research can provide information concerning the profile of a drug's effect, including physiological, biochemical, subjective, as well as performance assessment and begin to compare effect profiles across various drugs of abuse. Additionally, laboratory studies of drug effects are well equipped to investigate interactions with other drugs or with environmental stimuli (e.g., various stressors), which more closely model the ways in which drugs are used in the real world.

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Drug Free Workplace Program Research

Survey of Employer Anti-Drug Programs

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INTRODUCTION

Drug abuse affects our society at many levels--from the urban ghetto, to the suburban high school, to the workplace. In the workplace, it may influence attendance, productivity, product quality, and worker safety and morale. Relatively little information is available on a nationwide basis regarding the extent of private-sector efforts dealing with drug abuse in the office, factory, or store. Although a number of privately financed surveys have been conducted, they focused on relatively small segments of the private sector, with samples drawn from selective populations which are not representative of employers as a whole.[1]

Recognizing the need for comprehensive, scientifically collected information on the anti-drug efforts in private industry, the Congress, in the Drug Abuse Act of 1986 (Public Law 99-570), directed the Secretary of Labor to conduct research into employers' anti-drug abuse efforts. As a consequence, in the summer of 1988, the Bureau of Labor Statistics undertook the Survey of Employer Anti-drug Programs. The objective of the survey was to produce estimates of the number of private nonagricultural establishments with drug testing or employee assistance programs by employment size class, major industry division, and multi-state geographic region. A sample of some 7,500 establishments was selected from the Bureau's Unemployment Insurance Address File, supplemented with the Federal Railroad Administrations's list of railroad establishments.

Establishments, rather than companies, were the unit of measurement for this survey. An establishment is defined as an economic unit, usually at a single location, that produces goods or services. Although a single establishment can be a company, they are not necessarily equivalent, because companies or firms often consist of several establishments or workplaces.

The survey was conducted in two phases. First, a survey form was mailed to each sample unit to determine whether it had a drug-testing or employee assistance program. From the information gathered, estimates were developed

measuring the prevalence of these programs on a national basis. In the second phase, establishments identified in the first phase as having drug-testing programs were asked, among other questions, how many employees and applicants they tested over the previous year and how many of that group were identified as having used drugs. Also, those employers identified as having employee assistance programs or similar benefits were asked to indicate what features those programs had. Establishments not responding to these questionnaires, as well as those whose responses required clarification or more information, were recontacted by computer-assisted telephone interviewing.

Information on the survey definitions, estimation procedures, survey operations, and measures of sampling variability used appear in the explanatory notes.

INCIDENCE OF ANTI-DRUG PROGRAMS

Employer efforts to prevent or reduce the incidence of drug abuse among employees fall into two basic categories--detection and treatment.[2] Detection of drug use is intended to identify employees with drug problems and also to identify drug users who are seeking employment. Employer-sponsored treatment for employees with drug problems frequently takes place through an employee assistance program. Employee participation in these programs may be either voluntary or a condition of continued employment with the firm.

The survey results show clearly that the most important factor with regard to the incidence of these programs was establishment size--the number of employees in an establishment. The larger the establishment, the more likely it was to have drug-testing or employee assistance program. Differences in the incidence of such programs by industry were much less, and there was very little difference in the incidence of such programs among geographic regions.

Size of Establishment

The larger the establishment, the more likely it was to have a drug-testing or employee assistance program. Thus, for example, 43 percent of the Nation's largest establishments--those with 1,000 employees or more--had drug-testing programs, versus only about 2 percent of the smallest establishments--those with fewer than 50 workers. The incidence of employee assistance programs showed a comparable pattern--76 versus 9 percent. Because these small workplaces comprise the overwhelming majority of the Nations's establishments--over 90 percent--only 3 percent of establishments overall had drug-testing programs, and 7 percent had employee assistance

programs. The small establishments, on the other hand, employ only about 35 percent of all workers. Hence, proportionately more employees worked in establishments that have testing and assistance programs--about 20 and 31 percent, respectively (table 1).

The fact that a worker is in an establishment that has a drug-testing program does not mean that he or she will be tested for drug use, however. The information collected showed marked variation in testing practices. Some establishments only test applicants; others focus on particular occupations or suspected substance abuse; still others carry out random testing. For these reasons, relatively few employees were actually tested for drug use (see section on test results).

Several factors may underlie the lack of drug-testing or employee assistance programs among smaller establishments. One is that the owners or managers of small establishments may have a better opportunity to observe and interact with their employees on the job--and thus be in a position to observe possible signs of drug use--than managers in large establishments. Also, the cost of testing or assistance programs may be prohibitive for a small establishment. In addition, the pool of workers from which small employers hire may include friends, relatives, or other members of their community with whom they are familiar.

Industry

Establishments in mining (including oil and gas extraction), communications and public utilities, and transportation were the most likely to have testing programs, partly because of regulatory requirements.[3] Establishments least likely to have testing programs included those in the retail trade, services, and construction industries (table 2). Establishments in these industries tended to be small--76 percent of both construction and services establishments had fewer than 10 employees, as did 67 percent of retail trade firms--and they typically experience high worker turnover which would tend to increase testing expenses.

Region

Geographic region by itself appeared to have relatively little effect on the proportions of establishments with drug-testing or employee assistance programs (table 3). For instance, the proportion with testing programs ranged from 2 percent in the Northeast to around 4 percent in the South and Midwest. Overall, the incidence of establishments with assistance programs was somewhat higher in the Midwest than in other regions. When examined by size of firm, however, there were few, and typically very small, regional differences.

Table 1. Presence of a drug-testing or an employee assistance program by size of establishment: Private nonagricultural establishments and employees, summer 1988

Presence of program	Total	Size of establishment							
		1 to 9 employees	10 to 49 employees	50 to 99 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees	1,000 to 4,999 employees	5,000 employees or more
Establishments									
Total (thousands)	4,542.8	3,140.9	1,083.7	195.6	84.4	23.1	9.5	5.2	0.4
Percent									
With a drug testing program	3.2	.8	6.4	12.4	17.2	29.7	30.6	41.8	59.8
With an employee assistance program	6.5	3.7	9.7	15.7	29.4	45.3	53.9	70.4	83.0
With both a drug testing and an employee assistance program	1.4	.4	2.7	3.8	9.4	20.9	22.7	35.2	56.2
With neither a drug testing nor an employee assistance program	91.7	95.9	86.6	75.7	62.7	45.9	38.3	23.0	13.4
Considering implementation of									
A drug testing program	3.9	2.3	5.6	14.8	12.6	12.7	14.9	14.1	11.2
An employee assistance program	3.2	1.9	4.7	10.0	13.8	10.7	12.7	10.7	7.5
With a formal policy on drug use	13.1	6.4	24.0	35.9	50.4	53.5	59.9	71.2	82.9
Employees									
Total (thousands)	84,965.7	10,700.1	20,584.2	12,254.5	13,309.4	8,220.1	6,469.2	9,596.2	3,831.8
Percent in establishments									
With a drug testing program	19.6	1.1	7.3	12.3	17.8	29.2	30.4	43.6	67.6
With an employee assistance program	31.0	4.2	11.2	16.6	30.7	45.2	54.2	71.9	86.8
With both a drug testing and an employee assistance program	13.8	.7	3.5	3.9	9.7	20.7	22.8	36.4	64.4
With neither a drug testing nor an employee assistance program	63.2	95.5	84.9	75.0	61.3	46.3	38.2	20.9	10.0
Considering implementation of									
A drug testing program	10.1	2.4	6.2	15.1	12.8	13.1	14.3	12.5	8.1
An employee assistance program	8.6	2.0	5.3	9.8	14.1	10.7	13.0	10.0	6.7
With a formal policy on drug use	42.5	8.2	27.5	35.6	51.7	52.5	58.8	71.7	86.6

NOTE: The individual categories will sum to more than 100 percent because many establishments had more than 1 program or policy.

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Table 2. Presence of a drug-testing or an employee assistance program by industry: Private nonagricultural establishments and employees, summer 1988

Presence of program	Total	Mining	Construction	Manufacturing		Transportation	Communications and public utilities	Wholesale trade	Retail trade	Finance, insurance, and real estate	Services
				Durable goods	Nondurable goods						
Establishments											
Total (thousands)	4,542.8	31.6	458.1	193.9	141.2	153.5	37.5	467.9	1,101.8	403.9	1,553.4
Percent:											
With a drug-testing program	3.2	21.6	2.3	9.9	9.1	14.9	17.6	5.3	1.7	3.2	1.4
With an employee assistance program	6.5	18.8	2.8	10.4	12.8	10.9	30.9	7.8	4.7	9.2	5.5
With both a drug-testing and an employee assistance program	1.4	16.2	.7	4.1	4.8	4.8	11.7	2.3	.4	1.5	.6
With neither a drug-testing nor an employee assistance program	91.7	75.7	95.6	83.8	82.9	79.0	63.2	89.3	95.0	89.1	93.7
Considering implementation of:											
A drug-testing program	3.9	3.1	2.6	10.8	8.9	8.7	9.6	7.0	2.3	2.2	3.0
An employee assistance program	3.2	3.0	.8	8.4	7.5	8.8	5.9	2.9	2.6	2.5	3.0
With a formal policy on drug use	13.1	28.4	9.9	17.6	20.5	29.7	36.3	10.9	12.2	15.3	11.1
Employees											
Total (thousands)	84,965.7	712.0	5,011.9	11,159.0	7,767.1	3,149.1	2,209.0	5,835.0	18,413.0	6,539.0	24,170.6
Percent in establishments:											
With a drug-testing program	19.6	48.1	9.0	45.5	37.3	48.6	55.3	22.0	5.0	12.6	8.7
With an employee assistance program	31.0	47.9	10.6	55.8	45.3	36.0	76.1	17.6	17.0	40.5	25.2
With both a drug-testing and an employee assistance program	13.8	38.1	4.9	36.0	28.1	24.3	51.0	10.1	2.8	10.2	5.4
With neither a drug-testing nor an employee assistance program	63.2	42.1	85.3	34.8	45.6	39.6	19.7	70.5	80.7	57.1	71.6
Considering implementation of:											
A drug-testing program	10.1	8.8	5.9	16.5	18.1	12.3	10.0	10.1	6.3	6.5	9.2
An employee assistance program	8.6	7.7	4.4	11.1	10.0	13.4	5.1	7.0	7.9	7.9	8.8
With a formal policy on drug use	42.5	61.0	22.3	56.8	54.8	54.0	79.0	33.3	38.0	49.9	34.3

NOTE: The individual categories will sum to more than 100 percent because many establishments had more than 1 program or policy.

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Table 3. Presence of a drug-testing or an employee assistance program by Census region and existence of State legislation: Private nonagricultural establishments and employees, summer 1988

Presence of program	Total	Census region				States with legislation regulating drug-testing programs[1]	States without legislation regulating drug-testing programs
		Northeast	Midwest	South	West		
Establishments							
Total (thousands)	4,542.8	1,008.7	1,076.6	1,525.2	932.3	339.9	4,202.9
Percent							
With a drug-testing program	3.2	1.9	3.8	3.9	2.8	1.2	3.4
With an employee assistance program	6.5	6.0	8.9	5.5	6.2	12.2	6.1
With both a drug-testing and an employee assistance program	1.4	1.1	.9	2.0	1.6	.6	1.5
With neither a drug-testing nor an employee assistance program	91.7	93.2	88.2	92.6	92.6	87.2	92.1
Considering implementation of:							
A drug-testing program	3.9	4.8	3.5	3.1	4.7	5.7	3.8
An employee assistance program	3.2	4.8	3.2	3.1	1.6	3.2	3.2
With a formal policy on drug use	13.1	11.6	13.9	13.8	12.7	15.4	12.9
Employees							
Total (thousands)	84,965.7	19,153.7	20,898.7	27,980.0	16,933.2	5,424.5	79,541.1
Percent in establishments							
With a drug-testing program	19.6	16.7	20.7	21.4	18.4	12.4	20.1
With an employee assistance program	31.0	31.1	33.3	29.0	31.3	36.5	30.6
With both a drug-testing and an employee assistance program	13.8	12.9	13.8	14.4	13.7	9.6	14.0
With neither a drug-testing nor an employee assistance program	63.2	65.1	59.8	64.0	64.0	60.7	63.4
Considering implementation of:							
A drug-testing program	10.1	9.7	10.1	11.3	8.8	9.2	10.2
An employee assistance program	8.6	10.9	7.6	8.7	7.2	8.9	8.7
With a formal policy on drug use	42.5	39.2	41.6	44.5	44.1	42.4	42.5

[1] Seven States--Connecticut, Iowa, Minnesota, Montana, Rhode Island, Utah, and Vermont--were included in this group as of January 1988

NOTE: The individual categories will sum to more than 100 percent because many establishments had more than 1 program or policy.

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While some regulatory policies require testing in certain industries, several States have passed legislation restricting drug testing. As of the end of 1987, these States were: Connecticut, Iowa, Minnesota, Montana, Rhode Island, Utah and Vermont. Generally, the legislation limits employers with regard to who can be tested and requires employers as well as laboratories to follow a testing protocol designed to minimize the chance of error. About 1 percent of establishments in the States with legislation regulating testing had drug-testing programs, compared with 3 percent in States without such legislation. In contrast, a larger proportion of establishments in legislating States used employee assistance programs to prevent drug use--12 percent, compared with 6 percent in the nonlegislating States. However, there were fewer differences in this proportion by firm size than was the case for establishments with drug-testing programs.

Written Policy

Another facet of employers' anti-drug efforts is the existence of formal, written policies regarding drug use by employees. (A formal policy can also cover other aspects of employee conduct such as alcohol use, dress, etc.) Like testing and assistance programs, firm size was an important factor in determining the frequency with which such statements occurred. For instance, about 6 percent of those with fewer than 10 employees had formal policies, compared with 83 percent of those with 5,000 employees or more. Overall, 13 percent of all establishments, employing 43 percent of all nonfarm workers, had formal written policies regarding drug use (table 1).

Plans for Future Program Implementation

At the time the survey was conducted (summer 1988), about 4 percent of all employers without programs were considering beginning drug-testing programs sometime during the next 12 months, and 3 percent were thinking about starting employee assistance programs. In both cases, there was considerable variation by size of establishment. For example, the proportions considering drug testing ranged from 3 percent for those with fewer than 50 employees to 14 percent of establishments with 1,000 workers or more. By industry, the proportions considering drug testing ranged from 2 percent for establishments in finance, insurance, and real estate and retail trade to 11 percent for those in durable goods manufacturing.

PROGRAM CHARACTERISTICS

Testing Programs

Employers with testing programs appear to place a high priority on keeping potential drug problems out of the workplace. About 85 percent of establishments with testing programs targeted job applicants, while 64 percent focused on current employees (table 4).

Table 4. Drug-testing programs by type of program: Private nonagricultural establishments and employees, summer 1988

Type of program	Establishments	Employees in establishments
Total with a drug-testing program (thousands)	145.3	16,636.2
Percent with a program that tests		
Job applicants	85.2	88.5
Current employees	63.5	66.3
Percent with a program for job applicants that tests		
All applicants	83.4	89.0
Applicants for specific occupations	16.1	10.2
Some other group of applicants	1.1	.9
Percent with a program for current employees that tests		
All employees [1]	26.4	11.6
Employees suspected of drug use	64.2	81.3
Employees in specific occupations [1]	15.1	15.3
Some other group of employees	3.4	6.3

[1] Programs range from testing the entire group to random testing of a small percentage of the group.

NOTE: The individual categories will sum to more than 100 percent because many establishments had more than 1 program.

Most of the establishments with programs for testing applicants tested all applicants as one of the final steps in the hiring process; the extent to which this was done on a random basis is unknown. Only 16 percent limited the testing to persons who were applying for jobs in specific occupations. Among establishments with programs for testing employees, about two-thirds tested those suspected of drug use, while about one-fourth had programs under which all employees were subject to testing. With the exception of workers suspected of drug use, it appears that employers were most likely to test persons on a random basis, as only about 9 percent of workers in establishments with drug-testing programs were actually tested.

Establishments in mining, construction, transportation, and wholesale trade that had testing programs were about as likely to test applicants as current employees. All the remainder were more likely to have programs for testing applicants (table 5).

Test Results

Relatively few workers on private payrolls are actually tested for drugs. In the 12 months prior to the survey, establishments with testing programs reported testing a little under a million employees--or about 1 percent of all workers. Of these, about 9 percent tested positive for drug use. Of the 3.9 million applicants who were tested, 12 percent tested positive for drug use. These

Table 5. Drug-testing programs for job applicants or current employees by size of establishment and industry: Private nonagricultural establishments and employees, summer 1988

Size of establishment and industry	Establishments			Employees in establishments		
	With a drug-testing program (thousands)	Percent with a program that tests:		With a drug-testing program (thousands)	Percent with a program that tests:	
		Job applicants	Current employees		Job applicants	Current employees
Total establishments	145.3	85.2	83.5	18,636.2	88.5	88.3
Size of establishment						
1 to 9 employees	25.5	78.5	75.2	112.9	71.3	89.4
10 to 49 employees	68.9	84.4	81.2	1,509.8	86.8	61.6
50 to 99 employees	24.2	91.4	55.8	1,502.6	91.3	54.9
100 to 249 employees	14.5	87.8	64.5	2,368.0	88.3	64.8
250 to 499 employees	6.9	89.6	64.9	2,399.1	89.6	66.2
500 to 999 employees	2.9	85.4	63.3	1,966.3	84.7	64.3
1,000 to 4,999 employees	2.2	86.3	76.9	4,187.0	85.2	76.2
5,000 employees or more	.3	95.9	68.4	2,590.5	96.1	81.7
Industry						
Mining	6.8	99.0	92.3	342.7	98.1	84.7
Construction	10.5	82.1	90.9	449.1	72.6	89.9
Durable goods manufacturing	19.1	93.6	51.1	5,076.0	95.5	59.1
Nondurable goods manufacturing	12.8	98.0	66.9	2,893.9	95.6	65.9
Transportation	22.9	84.2	85.0	1,531.5	92.1	78.5
Communications and public utilities	6.6	88.8	69.6	1,221.1	98.0	77.3
Wholesale trade	24.7	82.8	58.6	1,280.6	87.4	56.4
Retail trade	7.4	92.9	61.1	927.0	85.9	58.5
Finance, insurance, and real estate	12.9	98.4	6.8	821.2	93.6	33.7
Services	21.5	82.2	66.1	2,093.1	56.5	83.3

NOTE: The individual categories will sum to more than 100 percent because many establishments had more than 1 program.

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test results should not be generalized as representative of the entire work force, because only a small proportion of all employers test, and so much of the testing is performed on persons suspected of drug use (table 6).

Employees in wholesale and retail trade who were tested for drug use had the highest positive rate--about 20 percent of those tested. The high positive rate in wholesale trade is probably due to the fact that 90 percent of the establishments that test employees test those suspected of using drugs.

Among applicants for jobs, the highest positive rates were also for those looking for jobs in wholesale and retail trade establishments--17 and 24 percent, respectively.

Employee Assistance Programs

Nearly 300,000 establishments had employee assistance programs that could help workers with drug problems. The overwhelming majority of these programs (9 out of 10) were management sponsored. The remainder were sponsored by a union or by both union and management (table 7).

With the exception of mining establishments, half or more of the firms contracted out their assistance programs. The reasons for the mining exception are not clear, since these establishments tend to be small, and small establishments generally have contracted-out programs.

Special Features

Employee assistance programs provide a wide array of assistance services to employees enrolled in them. The most common services are referrals to providers of treatment or counseling (provided by 97 percent of the assistance programs), counseling (77 percent), and follow-up procedures (82 percent) to monitor the success or failure of the individual client (table 8).

Less frequently offered features include a hotline (a telephone number available to employees enabling them to obtain help in dealing with a drug crisis), drug education or awareness program, and aid for family members. These latter features are more dependent on establishment size: less than half of the establishments with fewer than 10 employees that have assistance programs provide these features, and the proportions rise considerably as size increases.

Staffing

Assistance programs that were internally run typically had very few establishment employees assigned to staff them; the number assigned usually depended on the size of the establishment. As one would expect, few of the

Table 6. Drug-testing results[1] for current employees and job applicants by size of establishment and industry: Private nonagricultural establishments, summer 1988

Size of establishment and industry	Current employees			Job applicants	
	Total (thousands)	Tested		Tested	
		Total (thousands)	Percent positive	Total (thousands)	Percent positive
Total	84,965.7	953.1	8.8	3,913.7	11.9
Size of establishment					
1 to 9 employees	10,700.1	23.7	1	27.9	4.7
10 to 49 employees	20,584.2	161.1	9.4	539.0	11.2
50 to 99 employees	12,254.5	109.4	14.7	503.4	14.9
100 to 249 employees	13,309.4	237.6	7.3	864.0	13.3
250 to 499 employees	8,220.1	74.8	14.8	542.1	15.1
500 to 999 employees	6,469.2	78.0	4.9	520.4	9.4
1,000 to 4,999 employees	9,596.2	162.3	8.3	621.8	10.8
5,000 employees or more	3,831.8	106.3	6.3	295.2	5.4
Industry					
Mining	712.0	51.7	6.1	72.9	12.7
Construction	5,011.9	136.7	12.0	326.6	11.9
Durable goods manufacturing	11,159.0	169.8	12.1	767.6	11.2
Nondurable goods manufacturing	7,767.1	96.7	8.9	1,106.5	12.7
Transportation	3,149.1	283.0	5.6	451.8	9.9
Communications and public utilities	2,209.0	35.0	7.8	143.5	5.5
Wholesale trade	5,835.0	29.9	20.2	260.5	17.4
Retail trade	18,413.0	36.2	18.8	169.7	24.4
Finance, insurance, and real estate	6,539.0	-	-	308.4	6.7
Services	24,170.6	114.2	3.1	306.2	9.9

[1] Data refer to drug testing results during prior 12 months. The results refer only to the groups indicated and should not be applied to the entire work force.

NOTE: Dash represents zero or rounds to zero.

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195

Table 7. Employee assistance programs by sponsorship, source of program, size of establishment, and industry: Private nonagricultural establishments, summer 1988

Size of establishment and industry	Total with an employee assistance program (thousands)	Percent distribution by sponsorship and source of program					
		Sponsorship				Source of program	
		Management only	Union only	Management and union	Other	Internal	Contracted out
Total establishments	296.5	88.0	1.2	7.0	3.8	44.5	55.5
Size of establishment							
1 to 9 employees	115.7	91.8	-	7.7	.5	56.2	43.8
10 to 49 employees	105.5	86.6	2.4	5.0	6.0	38.5	61.5
50 to 99 employees	30.8	87.7	1.6	6.5	4.2	36.2	63.8
100 to 249 employees	24.8	82.1	.8	9.1	8.0	38.2	61.8
250 to 499 employees	10.5	84.6	.5	12.3	2.7	32.6	67.4
500 to 999 employees	5.1	80.5	-	13.5	6.1	38.9	61.1
1,000 to 4,999 employees	3.7	79.9	.4	16.0	3.7	39.1	60.9
5,000 employees or more	.4	71.3	.3	26.4	2.0	59.3	40.7
Industry							
Mining	5.9	96.4	-	3.2	.4	79.7	20.3
Construction	12.8	72.1	11.9	13.8	2.2	40.3	59.7
Durable goods manufacturing	20.2	86.8	-	11.0	2.5	27.5	72.5
Nondurable goods manufacturing	18.1	90.6	-	7.0	2.5	47.3	52.8
Transportation	16.7	58.4	3.3	29.4	8.9	42.2	57.8
Communications and public utilities	11.6	80.9	-	10.4	8.7	38.8	61.3
Wholesale trade	36.5	83.4	-	16.2	.4	34.5	65.5
Retail trade	51.6	96.3	.7	1.7	1.4	43.0	57.0
Finance, insurance, and real estate	37.2	98.4	-	.7	.9	47.0	53.0
Services	85.8	88.7	1.2	2.7	7.4	51.5	48.5
Total employees in establishments	26,323.0	81.2	.5	13.8	4.5	40.5	59.5

NOTE: Dash represents zero or rounds to zero.

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Table 8. Employee assistance programs by special features of program, size of establishment, and industry: Private nonagricultural establishments, summer 1988

Size of establishment and industry	Total with an employee assistance program (thousands)	Percent of programs with					
		A telephone hot line	An educational awareness program	Assistance for family members	Counseling services	Referral services	Followup services
Total establishments	296.5	48.6	58.3	58.9	76.6	97.2	81.9
Size of establishment							
1 to 9 employees	115.7	38.5	45.3	45.7	72.9	98.5	82.5
10 to 49 employees	105.5	55.5	67.5	64.0	79.9	95.4	82.5
50 to 99 employees	30.8	55.8	64.8	66.4	75.1	98.7	78.8
100 to 249 employees	24.8	46.2	56.8	69.7	77.7	97.9	80.1
250 to 499 employees	10.5	54.9	67.7	77.1	78.6	97.2	80.1
500 to 999 employees	5.1	54.9	67.2	72.8	78.1	96.0	83.9
1,000 to 4,999 employees	3.7	66.2	75.4	80.2	83.3	98.8	90.1
5,000 employees or more	4	66.9	85.8	80.7	89.6	99.6	91.0
Industry							
Mining	5.9	40.4	81.0	48.5	87.1	81.1	70.0
Construction	12.8	41.9	58.5	59.0	72.0	99.2	86.3
Durable goods manufacturing	20.2	67.6	75.8	65.4	90.4	94.1	89.1
Nondurable goods manufacturing	18.1	35.8	56.1	60.3	71.8	94.5	80.1
Transportation	16.7	58.2	64.5	59.9	78.8	94.1	68.5
Communications and public utilities	11.8	61.6	81.3	72.8	87.9	95.4	77.7
Wholesale trade	36.5	43.0	65.4	67.3	86.6	99.4	88.0
Retail trade	51.6	49.1	47.4	50.8	54.6	96.8	69.2
Finance, insurance, and real estate	37.2	48.9	34.2	55.0	77.7	97.9	75.7
Services	85.8	46.9	62.6	53.8	80.9	99.3	91.8
Total employees in establishments	26,323.0	58.4	70.9	74.9	80.8	97.9	84.2

NOTE: The individual categories will sum to more than 100 percent because many establishments had more than 1 program or feature.

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establishments with less than 20 workers had an employee staffing their assistance program; consequently, counseling, referral, and other services were probably provided by managerial personnel. In contrast, almost all the firms with 5,000 workers or more with employee-assistance programs had some staff assigned to the program, including 46 percent which had 2 to 4 employees and 39 percent that had 5 employees or more on the program staff (table 9).

CONCLUSIONS

Private industry efforts to reduce or eliminate problems in the workplace caused by drug abuse among workers fall into two categories--identification and assistance. By means of drug-testing programs, employers seek to identify drug users among both employees and job applicants. Through employee assistance programs, they try to help workers overcome drug problems, thereby reducing the extent of the problem in the workplace.

Such programs are not widespread. Establishments with few employees are unlikely to have either a testing or assistance program. Only among very large establishments are these programs common.

Drug-testing programs are aimed more towards job applicants than employees. Moreover, those programs under which employees are tested for drug use focus primarily on workers who are suspected of drug use. As a result, establishments reported testing relatively few of their workers. Of the applicants and employees who were tested, only about 1 in 10 tested positive for drug use.

Employee assistance programs were largely referral programs. That is, employees who were identified as drug users or who voluntarily came to the program for help were referred to organizations outside the establishment for counseling and/or treatment.

EXPLANATORY NOTES

Coverage

The Survey of Employer Anti-drug Programs was a one-time probability survey of private nonagricultural establishments in the United States with one or more employees in the first quarter of 1987. The sample was comprised of 7,502 establishments, selected from the BLS Unemployment Insurance Address File and supplemented with the Federal Railroad Administration's list of railroad establishments. Estimates were obtained on the existence and extent of drug-testing and employee assistance programs by industry, size of establishment, and Census region, as well as groups of applicants and employees affected by these programs.

Table 9. Internal employee assistance programs by size of program staff, size of establishment, and industry: Private nonagricultural establishments, summer 1988

Size of establishment and industry	Total (thousands)	Percent distribution by size of program staff				
		Total	No employees	1 employee	2 to 4 employees	5 employees or more
Total establishments	132.0	100.0	52.9	29.7	14.6	2.9
Size of establishment						
1 to 9 employees	61.0	100.0	63.0	33.4	3.6	-
10 to 49 employees	42.9	100.0	50.0	31.0	18.1	.9
50 to 99 employees	11.5	100.0	43.3	17.2	29.9	9.7
100 to 249 employees	9.6	100.0	35.4	21.3	33.2	10.1
250 to 499 employees	3.4	100.0	29.6	17.2	34.3	18.9
500 to 999 employees	2.0	100.0	16.9	21.0	50.5	11.6
1,000 to 4,999 employees	1.4	100.0	9.1	29.0	37.7	24.2
5,000 employees or more	.2	100.0	1.7	13.4	45.8	39.2
Industry						
Mining	4.7	100.0	31.3	10.1	57.5	1.1
Construction	5.2	100.0	78.0	11.9	8.9	1.2
Durable goods manufacturing	5.5	100.0	23.1	41.7	30.1	5.0
Nondurable goods manufacturing	8.5	100.0	24.6	43.5	28.4	3.5
Transportation	7.1	100.0	70.9	6.3	18.4	4.4
Communications and public utilities	4.5	100.0	57.9	17.8	11.8	12.5
Wholesale trade	12.6	100.0	58.7	26.3	14.9	.2
Retail trade	22.2	100.0	43.3	43.2	10.4	3.1
Finance, insurance, and real estate	17.5	100.0	52.8	41.2	5.3	.7
Services	44.2	100.0	61.0	24.5	11.4	3.1

NOTE: Dash represents zero or rounds to zero.

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Survey Definitions

Many of the concepts and definitions used in the Survey of Employer Anti-drug Programs are comparable to those in the monthly BLS payroll survey of nonagricultural establishments, the Current Employment Statistics survey, but many others are unique to this survey. Key definitions are as follows.

- **An establishment**--is an economic unit, such as a factory, mine, or store, which produces goods or services. It is generally at a single location and engaged predominantly in one economic activity. Where a single location encompasses two or more distinct activities, these are treated as separate establishments, provided that separate payroll records are available and certain other criteria are met.

- **Employees**--are persons on the payroll of the establishment. Excluded are proprietors, contract workers who are not on the establishment's payroll, the self-employed, unpaid volunteer workers, unpaid family workers, and farm or domestic workers.

- **Applicants**--for employment are people seeking employment with the establishment.

- **The Unemployment Insurance (UI) Address File**--is a microlevel employer file prepared annually by each State's Employment Security Agency and submitted to the Bureau of Labor Statistics. This file was used as the sample frame for the survey.

- **Industry classifications**--are combinations of the industry groups described in the 1972 *Standard Industrial Classification Manual*, Office of Management and Budget, 1972, as modified by the 1977 *Supplement*. Industry is classified on the basis of the major product or activity of the establishment, as determined by total sales or receipts of the calendar year prior to classification.

- **Computer-assisted telephone interviewing**--provides a computer-driven script with a link to the survey computer database. In this survey, the telephone interviewer followed the script on a computer screen and entered the answers provided by the respondent. The system edited the responses for consistency and reasonableness and prompted the interviewee to request any corrections or clarifications while the respondent was still on the phone.

- **Drugs**--include drugs classified as schedule I or II under the Controlled Substances Act--more specifically, opiates, cocaine, marijuana, hallucinogens, and their derivatives. Excluded from survey coverage are drugs for which persons have prescriptions (whether or not the prescription was legally obtained), steroids, and alcohol, although their metabolites may be detected in drug tests.

- **A formal written policy regarding drugs**--is a written statement available to all employees stating the establishment's policy with respect to the use of drugs by its employees. It may also state the policy regarding drug testing and employee assistance, if applicable. This statement may also delineate policy regarding alcohol use or any other aspect of employee conduct and deportment.

- **A drug test**--is a test designed to detect the presence of drugs or the metabolites of drugs in urine or blood specimens. Whether persons were identified as having used drugs was determined by the testing criteria used at each establishment.

- **Cannabis and derivatives**--includes anything containing tetrahydrocannabinol.

- **Cocaine**--includes anything containing cocaine.

- **Employee assistance, counseling, or treatment program**--is usually referred to as an employee assistance program. These programs enable troubled employees to receive help for a variety of personal problems. The programs can be run internally by organization personnel or through an outside contractor. Employee assistance program counselors assess a worker's particular problem and then usually offer short-term counseling, which is followed, if necessary, by referral to outside counseling or therapy for longer-term help. The programs are not necessarily restricted to drug problems and may also deal with a wide variety of the employee's domestic, social, or psychological problems.

- **A drug education or awareness program**--may consist of seminars, films, meetings, lectures, written materials, videos, etc., designed to acquaint employees with the dangers of drugs and/or to publicize the establishment's policy regarding the use of drugs. It may also include managerial or supervisory training to help managers and supervisors identify and deal with employees who use drugs.

- **A telephone hotline**--provides a telephone number to employees which puts them in touch with a counselor or advisor to obtain assistance in dealing with crises brought on by the use of drugs. It may also provide help with other problems such as alcohol.

- **A followup of any kind as part of an employee assistance program**--includes the monitoring of an employee for a specific period of time after identification of drug use. This may be required of such employees as a condition of continued employment. Monitoring can include testing and counseling.

- **The Census regions**--are defined as follows: *Northeast* includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *South* includes Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; ***Midwest*** includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; and the *West* includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

- **A legislative region**--was defined for purposes of estimation and analysis, because, at the time of the survey, seven States--Connecticut, Iowa, Minnesota, Montana, Rhode Island, Utah, and Vermont--had legislation directly affecting drug testing of employees or applicants. Some additional States have laws related to drug testing, such as licensing requirements for testing labs; however, because these laws do not directly limit drug testing at the workplace, these States were not grouped separately.

Survey Operations

1. Pretest

Upon completing the initial design of questions for the survey, eight local business establishments were selected for participation in a questionnaire pretest. Establishments known to have drug-testing or employee assistance programs were intentionally included in the pretest. The objective of the pretest was to determine whether the survey questions:

- Were worded in an unbiased way
- Would be understood by survey participants as intended
- Would effectively capture the information the survey was designed to collect

Each pretest interview was conducted in a personal visit by two BLS representatives. After the interviews were conducted, the survey task force met to discuss the pretest findings. The survey questions and definitions were then reevaluated and modified to better meet the objectives of the survey.

2. Operations Tests

Following the pretest and subsequent modifications to the questionnaire, an operations test was conducted using a sample of approximately 100 business establishments. This trial sample was conducted to test the processing procedures planned for use in the actual survey through a small-scale simulation and to identify and correct any weaknesses in the data collection procedures.

The operations test was conducted by mail, with telephone follow-up for nonrespondents. The solicitation package consisted of a mailing envelope; a pre-addressed, postage-paid return envelope; a solicitation letter; and a survey questionnaire. While the test did not uncover any substantial operational problems, it did find that many survey respondents did not properly follow the instructions for completing the questionnaire. As a result, the questionnaire was modified, and a second operations test was conducted with the revised questions. No significant changes were made to the operations plan or to the questionnaire as a result of the second operations test.

3. Conducting the Survey

The survey was conducted in two phases. In the first phase, a potential respondent was asked to complete a short questionnaire. This questionnaire, BLS 380A, included questions asking if the establishment had a drug-testing program and/or employee assistance plan. If the establishment had either, a second (follow-up) questionnaire was sent to the respondent:

- BLS 380B, if there was testing but no employee assistance program
- BLS 380C, if there was an employee assistance program but no testing
- BLS 380D, if there was both testing and an employee assistance program

Each of the follow-up questionnaires was designed to ask only questions that were consistent with the respondent's answers on BLS 380A.

Initial solicitation for the BLS 380A phase of the survey was conducted by mail. The first contact to solicit follow-up data was usually conducted by mailing the B, C, or D forms. However, if it was necessary to contact a BLS

380A establishment by telephone--particularly in the case of nonresponse--the respondents who had these programs were asked to provide the data for the B, C, or D forms during the telephone interview.

As suggested above, establishments that did not respond to mail solicitation were contacted by telephone. Re-contacts to reconcile questionable or incomplete responses were also conducted primarily by telephone. Mail generally was used in these cases only at a respondent's request or when telephone contacts were unsuccessful.

Computer-assisted telephone interviewing was used by survey interviewers in most of the telephone follow-ups. This facilitated telephone interviews in several ways:

- Provided introductory and questionnaire script
- Allowed the interviewer to enter the respondents' data directly into the survey database
- Edited the reported data for consistency with pre-established criteria and identified potential errors during the interview
- Mechanically assigned status codes used to classify sample records for survey processing and management
- Helped interviewers control their assigned samples

Scope and Sample Design

The Survey of Employer Anti-drug Programs was a one-time probability sample survey of 7,502 private nonagricultural establishments in the United States with one or more employees during the first quarter of 1987. The sampling frame used for this survey was constructed from the 1987 Unemployment Insurance Address File maintained by the Bureau of Labor Statistics and the Federal Railroad Administration's list of railroad establishments. The sampling frames contained approximately 4.5 million establishments, accounting for about 85.0 million employees.

The principal feature of the survey's sample design was its use of stratified, systematic sampling with a ratio estimator. The establishments were stratified into 400 sample strata, defined by 5 geographic regions, 10 Standard Industrial Classification (SIC) groupings, and 8 employment size classes, as shown below.

The five geographic regions were:

1. Connecticut, Iowa, Minnesota, Montana, Rhode Island, Utah, and Vermont. These States were placed into a separate stratum, because it was determined that they have drug-testing legislation that might affect the estimates

2. All States in the Northeastern region, except for Connecticut, Rhode Island, and Vermont

3. All States in the Southern region

4. All States in the Midwestern region, except for Iowa and Minnesota

5. All States in the Western region except for Montana and Utah

The 10 SIC groupings were:

Industry	1972 SIC Code
1. Mining	10-14
2. Construction	15-17
3. Durable manufacturing	24,25, and 32-39
4. Nondurable manufacturing	20-23, and 26-31
5. Transportation	40-42, and 44-47
6. Communications and public utilities	48 and 49
7. Wholesale trade	50 and 51
8. Retail Trade	52-59
9. Finance, insurance, and real estate	60-67
10. Services	07, 70-87, and 89

The eight employment size classes were:

Size class	Number of employees, first quarter of 1987
1	1-9
2	10-49
3	50-99
4	100-249
5	250-499
6	500-999
7	1,000-4,999
8	5,000 and above

All of the establishments on the sample frame with 5,000 employees or more were included in the sample with certainty. Also, if any sample stratum contained five establishments or less, then those establishments were also selected for the sample with certainty. Sample sizes for the noncertainty strata were determined based on a target standard error of 7.5 percent for an estimate of P (where P is the estimate of the proportion of establishments with a drug-testing program or the proportion with an employee assistance program). In order to be conservative, a value of P=50 percent was assumed in each sampling stratum. The final sample for the survey contained 480 establishments belonging to the certainty stratum and 7,022 establishments that were selected in each noncertainty stratum, using a systematic sampling procedure with a random start.

Estimation

1. Weighting

To derive the population estimates, the sample establishments with usable responses were weighted to represent all establishments in their sampling stratum. Each sample weight consisted of two factors. The first factor was the inverse of the probability of selection. The second factor was a nonresponse adjustment factor used to adjust estimates for establishments that did not respond to the questionnaire

or did not respond to a particular item on the questionnaire. For each of the 400 sample strata *and* for each item on the questionnaire, a nonresponse adjustment factor was calculated as follows:

$$\frac{\text{Total number of eligible establishments}}{\text{Total number of usable establishments}}$$

An establishment was eligible if it should have responded to the questionnaire or a particular item within it. The usable sample size was the number of establishments which provided a response to a particular item. If the nonresponse adjustment factor for any given item in a stratum was greater than a predetermined maximum value, then the stratum was collapsed with other strata in the same SIC grouping until the nonresponse adjustment factor for the combined stratum was less than the maximum value.

2. Response Rates

Data collection for the survey was started on June 13 and closed out on September 9. The usable response rates were 92.4 percent for BLS 380-A, 88.1 percent for BLS 380B, 88.8 percent for BLS 380C, and 84.5 percent for BLS 380D. An analysis of usable reports showed that item response rates to individual questions across all sample strata were relatively high. They were lower, however, for questions that requested counts concerning drug-testing results. Survey item response rates were calculated across all sample strata as follows:

$$\frac{\text{Number of usable responses for the item}}{\text{Eligible sample size}} \times 100$$

As shown in table A, the usable response rates for individual questions ranged from 71.1 to 100 percent. The eligible sample sizes used to calculate these item response rates are based on the following definitions. (Questions from the B, C, and D forms are designated by their numbering as they appear on BLS 390D.)

Table A. Response rates for individual items

BLS 380 form type	Question number	Eligible sample size	Number of usable responses	Response rate for item (percent)
A	1	6,502	6,502	100.0
A	2	6,502	6,501	100.0
A	3	6,502	6,502	100.0
A	4A	1,495	1,495	100.0
A	4B	1,495	1,495	100.0
A	4C	1,495	1,495	100.0
A	4D	1,495	1,495	100.0
A	4E	1,495	1,495	100.0
A	4F	1,495	1,495	100.0
A	5	5,007	4,999	99.8
A	6	6,502	6,502	100.0
A	7	4,187	4,171	99.6
B/C/D	1	1,341	1,067	79.6
B/C/D	2	1,341	1,043	77.8
B/C/D	3A	1,341	954	71.1
B/C/D	3B	1,341	958	71.4
B/C/D	3C	1,341	957	71.4
B/C/D	4	1,341	1,140	85.0
B/C/D	5	1,087	841	77.4
B/C/D	6	1,087	818	75.3
B/C/D	7A	1,087	780	71.8
B/C/D	7B	1,087	780	71.8
B/C/D	7C	1,087	781	71.8
B/C/D	8	1,087	890	81.9
B/C/D	9A	2,315	2,032	87.8
B/C/D	9B	2,315	2,032	87.8
B/C/D	9C	2,315	2,032	87.8
B/C/D	9D	2,315	2,032	87.8
B/C/D	10	2,315	1,976	85.4
B/C/D	11	2,315	2,031	87.7
B/C/D	12	2,315	2,022	87.3
B/C/D	13	2,315	2,024	87.4
B/C/D	14	2,315	2,023	87.4
B/C/D	15	2,315	2,022	87.3
B/C/D	16	2,315	2,030	87.7
B/C/D	17	2,315	2,014	87.0

Survey question (item)	Definition used to determine sample size
BLS 380A, 1-3 and 6	Units that provided a usable response for BLS 380A
BLS 380A, 4A-F	Units that responded yes to BLS 380A, item 3
BLS 380A,5	Units that responded no to BLS 380A, item 3
BLS 380A,7	Units that responded no to BLS 380A, item 6
BLS 380B/C/D,1-4	Units that responded yes to BLS 380A, item 4A, or 4B
BLS 380B/C/D,5-8	Units that responded yes to BLS 380A, item 4C, D, E, or F
BLS 380B/C/D, 9A-17	Units that responded yes to BLS 380A, item 6

3. Benchmark Adjustments

A combined ratio estimator was used to develop the final estimates. The auxiliary variable used to adjust or benchmark the estimates was total employment or total number of establishments, depending on the type of estimate desired. Benchmark factors (BMF) for employment (E) and units (U), respectively, were calculated as follows:

$$BMF_{hi}(E) = \frac{\text{Benchmark employment for the } i^{th} \text{ employment size class within } h^{th} \text{ SIC grouping}}{\text{Total weighted, nonresponse adjusted reported employment for the ith employment size class within the } h^{th} \text{ SIC grouping}}$$

$$BMF_{hi}(U) = \frac{\text{Benchmark number of establishments for the } i^{th} \text{ employment size class within } h^{th} \text{ SIC grouping}}{\text{Total weighted, nonresponse adjusted number of establishments for the } i^{th} \text{ employment size class within the } h^{th} \text{ SIC grouping}}$$

The employment level from the BLS Current Employment Statistics program for March 1988 was used as the employee benchmark, and the number of establishments was taken from comprehensive counts from State unemployment insurance files (ES-202 program) for the first quarter of 1987.

4. **Final Estimate**

The weighted, nonresponse adjusted estimates were then multiplied by their corresponding benchmark factors to obtain the final estimates. Estimates for percentages were obtained by dividing the final estimates at the estimating cell level by the appropriate total value.

For each estimate, an estimate of its standard error was calculated using a random group technique. This technique is based upon dividing the sample into several subsamples and calculating separate estimates for each subsample. The standard error estimate is based upon the variability of these subsample estimates.

Reliability of Estimates

Estimates developed from the sample may differ from the results of a complete census of all the establishments in the sample frame. Two types of error, sampling and nonsampling, are possible in an estimate based on a sample survey. Sampling error occurs because observations are made only on a sample, not on the entire population. Nonsampling error can be attributed to many sources, e.g., inability to obtain information about all cases in the sample; differences in the respondents' interpretation of questions; inability of respondents to provide correct information; errors in recording, coding, or processing the data; and failure to represent all units in the population.

The particular sample used in this survey is one of a large number of all possible samples of the same size that could have been selected using the same sample design. Estimates derived from the different samples would differ from each other. The standard or sampling error of a survey estimate is a measure of the variation among the estimates from all possible samples. Estimated standard errors for key statistics appear in table B. Estimated standard errors for other statistics are available upon request.

The sample estimate, and an estimate of its standard error, enable one to construct interval estimates with prescribed confidence that the interval includes the average value of the estimates obtained from all possible samples that could have been chosen using the same sample design that was used for this survey.

To illustrate, if all possible samples were selected and if each of these were surveyed under essentially the same conditions and an estimate and its estimated sampling error were calculated from each sample, then:

Table B. Standard errors of selected percentages

Category	Percent of establishments		Percent of employees in establishments	
	With a drug testing program	With an employee assistance program	With a drug testing program	With an employee assistance program
Total	0.34	0.43	0.57	0.70
Size of establishment				
1 to 9 employees	.27	.61	.35	.74
10 to 49 employees	.80	.84	.93	.94
50 to 99 employees	3.12	1.47	3.16	1.69
100 to 249 employees	1.57	1.71	1.46	1.72
250 to 499 employees	2.09	3.06	2.01	2.86
500 to 999 employees	3.09	2.61	2.76	2.51
1,000 to 4,999 employees	1.66	2.08	2.31	2.55
5,000 employees or more	2.98	3.20	2.14	2.26
Industry				
Mining	6.35	5.71	2.16	3.05
Construction	.71	.97	1.92	1.56
Durable goods manufacturing	1.49	2.31	1.77	1.53
Nondurable goods manufacturing	1.59	2.41	2.36	2.42
Transportation	3.91	2.70	4.14	2.47
Communications and public utilities	4.17	3.87	3.25	2.29
Wholesale trade	1.81	2.38	2.55	2.69
Retail trade	.14	.96	.95	1.11
Finance, insurance, and real estate	2.01	2.71	3.35	3.72
Services	.45	.87	.78	1.20
Census region				
Northeast	.28	1.27	.90	1.36
Midwest	.91	1.34	.92	1.08
South	.69	.84	.85	1.05
West	.77	.86	1.47	1.51

- Approximately 68 percent of the intervals from 1 standard error below to 1 standard error above the derived estimate would include the average value of all possible samples. This interval is called a 68-percent confidence interval.

- Approximately 90 percent of the intervals from 1.6 standard errors below to 1.6 standard errors above the derived estimate would include the average value of all possible samples. This interval is called a 90-percent confidence interval.

- Approximately 95 percent of the intervals from 2 standard errors below to 2 standard errors above the derived estimate would include the average value of all possible samples. This interval is called a 95-percent confidence interval.

As an example, the estimate of the percent of the establishments with an employee assistance program is 6.50 percent, and the estimate of 1 standard error is .43 percent. The 90 percent confidence interval (1.6 standard errors) was used for the analysis in this report; In this example, 1.6 standard errors is .69 percent, and the confidence interval for this estimate is 5.81 percent to 7.19 percent. Approximately 90 percent of the intervals constructed in this manner will include the true percentage, and one can say with 90-percent confidence that the true percentage is in the interval, when the true percentage is defined to be the average value of all possible samples.

The estimated standard errors primarily indicate the magnitude of the sampling error. They do not measure *nonsampling error,* including any biases in the data. Significant efforts were made to reduce the nonsampling errors in recording, coding, and processing the data. For example, the completed forms were checked for data consistency and apparent inconsistencies were reconciled, but this process probably did not eliminate all recording, coding, and processing errors in the survey.

In adjusting the strata sample weights for the nonrespondents, nonsampling error could occur, because it was assumed that the characteristics of the nonrespondents within the stratum were the same as those of the respondents. To the extent this is not true, bias is introduced in the data. The magnitude of this bias is not known.

Where there was a large nonresponse for a particular item, such as with the results of drug testing, there is greater potential for large nonsampling error. Thus, the data on table 6 of this report should be viewed with greater caution than the other tables. In fact, data collected on the questions concerning drug testing for specific types of drugs (cannabis, cocaine, etc.)--based on questions 3 and 7 in forms 380B and 380D--were not tabulated at

all because of the very high rates of nonresponse, as well as other suspected response errors.

In some instances, respondents may interpret questions differently than intended. This, too, can introduce a bias. For example, questions 4 and 8 on forms BLS 380B and BLS 380D were asked to determine whether confirmation tests were conducted to verify initial test results. However, comments returned with the questionnaires indicated that at least some respondents interpreted this as a follow-up test conducted long after a positive test result to determine whether an employee had stopped using drugs. Because of this discrepancy, data from those questions were not tabulated or analyzed.

Nonsampling error also occurs when the respondent does not have the requested data available. For example, it was learned that at least 10 percent of the units that responded to the survey questions regarding the total number of employees or applicants that tested positive for drug use could provide only estimated responses. The effect this error has on the final estimates is unknown and would depend on how accurate respondents' knowledge is of their firms's drug testing.

Response Analysis Survey

In an attempt to measure the magnitude of nonsampling errors that are caused by definitional difficulties on the questionnaire, misinterpretation of questions, the respondents' recall factor, etc., a response analysis survey was conducted in conjunction with the Survey of Employer Anti-drug Programs. This involved a sample of 95 randomly selected sample establishments with 50 employees or more, selected from the usable establishments responding by mail (with no computer-assisted telephone interviewing follow-up) that indicated that they had neither a drug-testing nor employee assistance program. The response analysis survey was designed to: (1) probe these respondents on their establishments' programs and policies that may relate to drug testing or employee assistance and (2) evaluate whether the definitions of "drug-testing program" and "employee assistance program" were understood by the respondent in the same way as they were defined in the original questionnaire. The response analysis survey was also designed to validate the original responses of these units by verifying that the respondents had not overlooked some important piece of information that would yield a change in response.

In the case of the "drug-testing program," the results from the response analysis survey indicated that a small source of bias was the respondents' failure to remember that some drug testing had been undertaken as part of a physical examination provided or required by the firm. Based on the limited

sample size, it is estimated that the percentage of establishments with a drug-testing program could increase from 3.2 to 3.3 percent--a change of only one-tenth of a percentage point--if corrected for this bias. The response analysis survey also indicated that the respondents understood the "employee assistance program" to be a very formal and structured benefit available to the employee. Consequently, the respondents did not change their response from "no" to "yes," even though many establishments provided educational programs on drug abuse and offered referrals to outside agencies.

When examining estimates from the Survey of Employer Anti-drug Programs, particular care should be exercised in the interpretation of small differences between estimates, because the sampling errors for them tend to be relatively large.

ENDNOTES

[1] Ten surveys on employee drug testing were summarized in *Employee Drug Testing: Information on Private Sector Programs*, GAO/GGD-88-32 (General Accounting Office, March 1988). Of the 10, 7 were directed at members of business or professional organizations, 2 at very large companies, and 1 at Fortune 500 companies. The sample for a more recent survey, conducted in 1988 by the Gallup Organization for Hoffman-La Roche, Inc. consisted of 706 companies with 20 employees or more, selected from Trinet, Inc.'s large Corporation Database. Companies in this database consist of main offices and parent companies only. See *Drug Testing at Work: A Survey of American Corporations* (Gallup Corporation 1988).

[2] For a discussion of drug-testing procedures, see *Alcohol and Drugs in the Workplace: Costs, Control and Controversies*, Bureau of National Affairs, Inc. (Washington, D.C. 1986) pp. 27-38.

[3] See, for example, U.S. Department of Transportation, Federal Railway Administration, *Field Manual: Control of Alcohol and Drug Use in Railroad Operations*, pp. A61-A72.

ACKNOWLEDGMENTS

The data in this report are based on information collected in the Survey of Employer Anti-Drug Programs conducted by the Bureau of Labor Statistics in the Summer of 1988. This was a nationwide probability sample survey of private nonagricultural establishments with one or more employees, stratified by employment size class, major industry division, and multistate region. It was designed to collect information on the incidence of drug-testing and employee assistance programs in private industry. In addition, the survey also

collected data on drug-test results and the characteristics of employee assistance programs. The survey was sponsored by the Office of the Assistant Secretary for Policy, U.S. Department of Labor.

The report was prepared in the Office of Employment and Unemployment Statistics under the direction of Thomas J. Plews, Associate Commissioner. Survey work was coordinated by George D. Stamas of the Division of Monthly Industry Employment Statistics. The questionnaires were designed by Mark Palmisano of the Division of Statistical Methods and Howard V. Hayghe of the Division of Labor Force Statistics. Sample design and estimation methods were provided by Michael B. Witt and Shail J. Butani of the Division of Statistical Methods. Survey operations were conducted under the direction of Guy A. Toscano of the Division of Federal/State Monthly Surveys, Office of Survey Processing, and computer programming was directed by James K. Fox of the same division. Gloria P. Green coordinated the tabulation and other production services, and Howard V. Hayghe prepared the analysis.

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Re-Examining the Role of Supervisor Training

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INTRODUCTION

Employee Assistance Programs (EAPs) have long recognized that the supervisor is crucial to the process of managing troubled employees in the workplace (Googins and Kurtz, 1980; Hoffman and Roman, 1984). By virtue of their role in the work environment, supervisors are in a unique position, not only to identify troubled employees, but also to intervene in a meaningful way. In light of the pivotal part supervisors play for EAPs, the need to train supervisors has also been accepted and given high priority (Trice and Belasco, 1968; Trice and Roman, 1972). Yet despite the general acceptance of supervisors and supervisor training as central to EAPs, there has been very little research in this area by EAP professionals. Thus, with only a few notable exceptions (Googins and Kurtz, 1980; Hoffman and Roman, 1984; Trice and Beyer, 1981), supervisor training remains relatively unexamined despite its importance to the EAP field. Such lack of research on EAP training appears to reflect problems reported within the larger management training field. A recent meta-analysis of the management training research literature (Burke and Day, 1986) reports that the vast majority of research on management training is not empirical or based on theory. Instead, most research remains dominated by anecdotal presentations. This report concludes that much more research is urgently needed if a better understanding of the effectiveness of training on various outcome variables is to be achieved.

The data presented here are from the first phase of a NIDA-funded project to study the effectiveness of supervisor training on several specific outcome measures. In phase one, a national telephone survey of EAPs was conducted to obtain a more accurate picture of the extent and nature of supervisor training within EAPs. These data are useful to establish a baseline of current supervisor training practices for EAPs, as well as to give EAPs a sense of where they stand in relation to other training initiatives occurring within the workplace. These data will also guide the design of experimental groups employed in the second phase of the study where the effectiveness of various

types of supervisor training practices will be tested in a controlled experiment.

METHODS

The sample for the telephone survey was established by first selecting a State at random from each of the five geographic sections of the United States. Initially, a letter was sent to all EAPs in each State which were listed in the ALMACA directory. These EAPs were asked to add to our list those EAPs which were in their State but not on our list. By this process, we were able to identify virtually the entire population of EAPs in each State. A total of 114 EAPs were then randomly selected and asked to participate in the survey. Of these, 94 agreed to take part in the survey which constituted an 82.5 percent participation rate.

A semistructured telephone survey was constructed and employed for data gathering. This instrument consisted of original items which were generated by a three-member expert panel of EAP professionals. A pretest was then conducted in order to rectify any problems before it was used in the actual nationwide survey. The telephone interviews were conducted by four research staff who were trained to follow a series of standard procedures which had been previously established. A copy of the instrument was sent to each participant prior to the actual interview in order to maximize the quality of information gathered and minimize the time needed for the actual telephone interview. Most interviews lasted approximately 40-50 minutes depending upon the flow of the interview.

The sample, as shown in figure 1, consisted of 94 EAPs which have existed for an average of 8 years and have a median number of eligible employees of 5000.

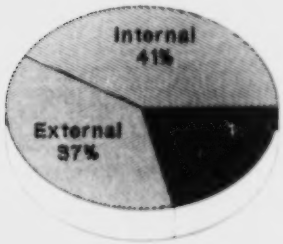
Nearly even numbers of internal programs (41 percent) and external programs (37 percent) were surveyed, and the remainder (21 percent) described themselves as combined internal/external programs. The populations served by these EAPs were reported to be 16 percent suburban, 18 percent urban, and 66 percent a combination suburban and urban.

RESULTS

Initial questions focused on attitudes of EAP personnel towards supervisor training. Overall, the results indicated a strong, positive view towards training. Over 92 percent agreed that "An EAP must conduct supervisor training to be considered a quality EAP." In addition, over 94 percent disagreed with the statement that "Supervisor training is a good idea, but a

Figure 1.
Description of Sample

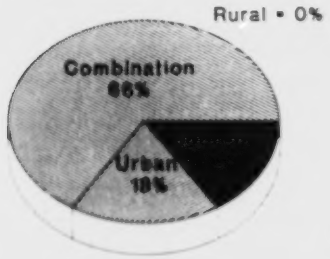
EAP Type



Age of EAP

$\bar{X}$ = 8.02 yrs.
SD = 5.27 yrs.

Population Served



Number of Eligible Employees;

Median = 5000

luxury in light of other EAP priorities." Next, respondents were asked to describe the supervisor training sessions which they conducted during the previous year. A total of 87 percent reported they had conducted supervisor training during this time period. The majority of this training was conducted by EAP staff (91 percent), however, over one-third of these staff (36.8 percent) had never received training as trainers. Figure 2 shows that most sessions were conducted with fewer than 20 participants (62 percent) in attendance, although 35 percent of supervisor training sessions had between 21 and 40 participants. The average length of a training session was 2.6 hours. Most EAPs focused their training on job performance (76 percent). However, 21 percent of the EAPs surveyed focused primarily on substance abuse instead of a broad-brush approach. Virtually all of the EAPs (97 percent) instruct supervisors in the principals of constructive confrontation.

Training methods were also examined in the survey. All supervisor training sessions (100 percent) were stand-up presentations and had a question and answer period. Eighty-nine percent included the total group in some form of discussion, and 74 percent utilized a video or film as a training component. As figure 3 illustrates, a variety of other training techniques were also found to be commonly used. Most popular were the use of small group discussions (54 percent), self-teaching guides (46 percent), slides/overheads (40 percent) and role play (29 percent).

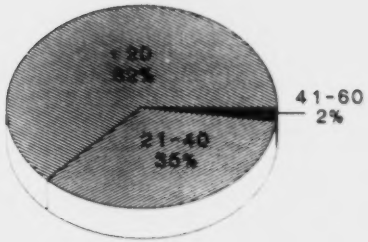
EAP personnel were asked how effective they felt supervisor training was. Figure 4 shows that those surveyed perceive supervisor training to be effective in achieving a variety of goals including increased referrals, increased awareness of the EAP, improved attitudes toward the EAP and troubled employee, and better integration of the EAP into the corporation. When asked about problems affecting supervisor training, respondents focused on several barriers to doing more supervisor training. Figure 5 illustrates that the problems most reported included time constraints of EAP staff, lack of upper management support, budgetary constraints, supervisor apathy, and organizational change. In contrast, very few respondents felt that the trainers themselves or the curriculum employed were problems of any significance.

Preliminary analyses were also conducted to compare EAPs which conducted supervisor training in the previous year with those which did not conduct training. EAPs with supervisor training had a higher referral rate (5.2 percent) than EAPs with no training (2.1 percent). This difference was statistically significant ($p < .001$). There were also significant correlations between supervisor referrals, the amount of training done in an organization, and the training qualifications of the trainers. These findings are interesting in that they provide some beginning measures on effectiveness of training and trainers. However, it must be emphasized that these analyses have not controlled for a variety of confounding variables. In particular, the definition

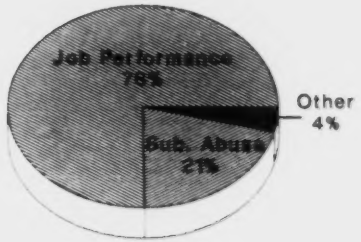
Figure 2.

Supervisor Training Sessions

Group Size



Focus of Session



Length of Session

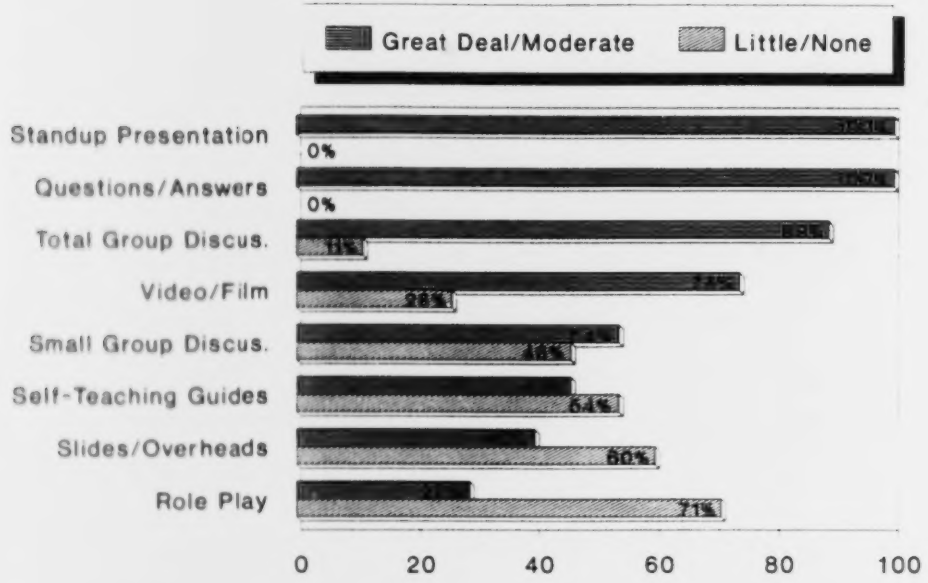
$\bar{X}$ = 2.6 hrs.
SD = 1.3 hrs.

Constructive Confrontation

Yes = 97%
No = 3%

Figure 3.

Supervisor Training Methods



229

Figure 4.

Perceived Effectiveness of Supervisor Training

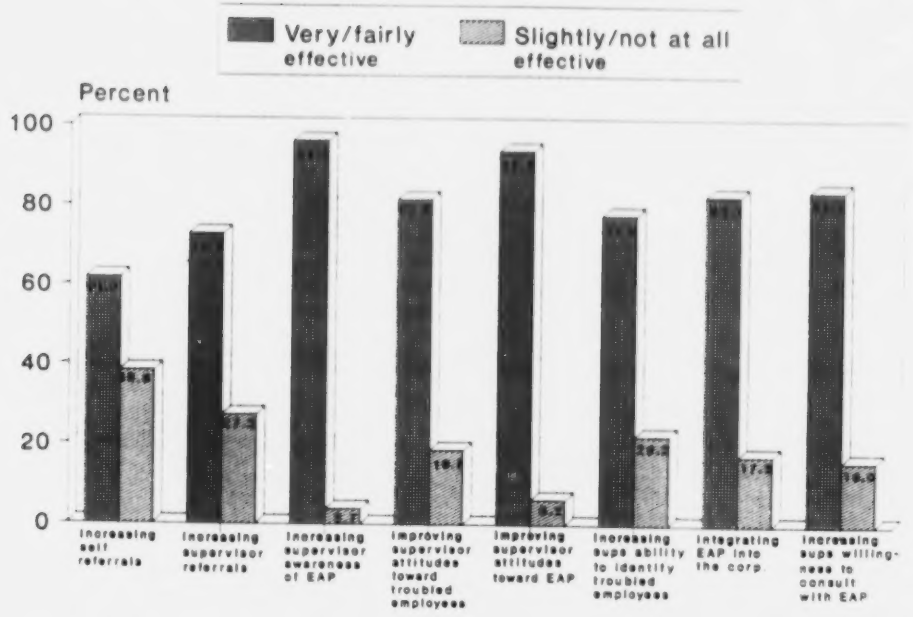
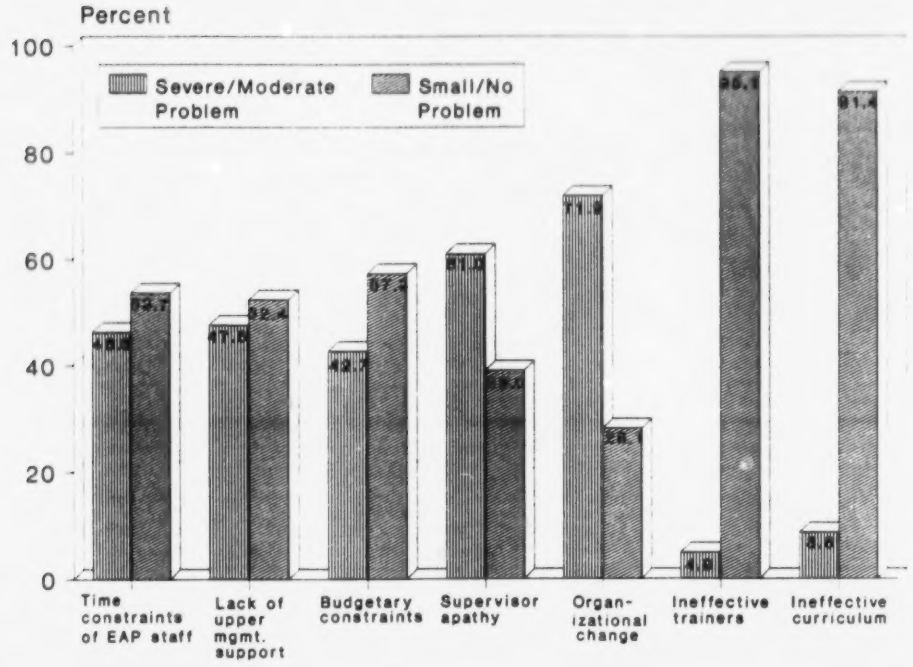


Figure 5.

Problems with Supervisor Training



of supervisor referral was not consistent across EAPs making comparisons difficult to interpret.

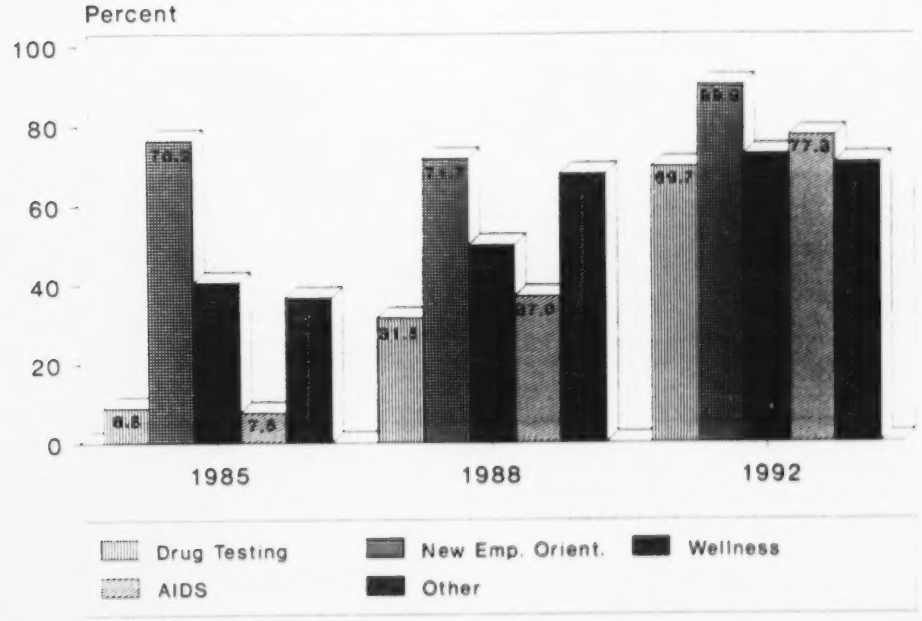
Finally, training trends were explored using data from 1985, 1988, and 1992 (projected). Figure 6 reveals that other types of EAP training (e.g., drug testing, wellness, new employee orientation, AIDS) are increasing and expected to increase even further in the next few years.

DISCUSSION

Overall, the results of the survey indicate that most EAPs continue to feel very positive about their supervisor training programs and feel that training is essential to the mission of the EAP. Those surveyed felt that supervisor training is effective in achieving its goals, but were concerned that they were not doing enough training because of limited resources. Problems associated with training were perceived to be mostly organizational constraints and not related to the trainers, the curriculum or issues of efficacy. Training is seen to be mostly free-standing. That is, it is conducted almost exclusively by the EAP itself, using EAP counselors as trainers. It is also fairly homogenous in that it primarily emphasizes a job performance model of problem identification and instructs supervisors in the use of constructive confrontation. Training sessions typically consist of stand-up presentations and include question and answer periods. Some changes in supervisor training practices are seen to be taking place. Generally, these changes reflect the use of more professional training techniques and some diversification in terms of training focus and target group.

In many respects, EAP training is similar to other management training programs which exist within the corporation. For example, in terms of its objectives, management training programs are, for the most part, designed to teach or improve management skills and on-the-job performance (Burke and Day, 1986; Wexley and Latham, 1981; Goldstein, 1980). Similarly, EAP training is also designed to help supervisors improve their management skills and monitor employee job performance. There are also many parallels seen between these training programs in terms of methods and curriculum. Both employ a prescribed set of curriculum components and a range of techniques to present information. In a time when there is increased recognition of the efficacy of training managers and supervisors (Burke and Day, 1986; Wexley and Latham, 1981; Deming, 1986), one would expect to find well-established linkages between EAPs and the management training field. Unfortunately, such linkages are seldom found. The evolution of EAP training has taken a very distinctive track which has kept it generally quite separate from the mainstream of corporate training. While this autonomy has enabled the EAP to deliver what it considers unique EAP material, it has created problems in several areas as discussed below.

Figure 6.
Training Trends



Training Quality

Because the EAP training evolved as a separate program, it rarely was conducted or tied to the corporate training department. In addition, the EAP staff were expected to deliver the training regardless of their skill or interest in training. Also the training content and curriculum were rarely developed within a training and education format which examines the learning process. Most often, EAP staff adopted points of the constructive confrontation model, drew upon some alcoholism training, and tried to get their message across despite the apathy or resistance of the supervisors. These are hardly ideal training circumstances given the importance of supervisors to the mission of EAPs. While data from the current survey indicates a growing training sophistication, in contrast to the training of even a decade ago, it is clear that many EAP staff have little or no training in the development or deliverance of effective curriculum. If the corporation has recognized the specialized skills and knowledge necessary for training by creating a training department or unit, it is somewhat presumptuous, in light of EAP staff training skills, for EAPs to create a separate training function.

Staffing Costs

Most EAPs have determined that it is essential for EAP staff, rather than the training unit, to deliver the training since it requires specialized knowledge and skills. This has placed increased pressure on staff time due to the multiple role requirements. Training supervisors is an ongoing process and consequently an ongoing time commitment of the EAP staff. As caseloads increase, the time requirements for training compete with client hours and contact. In addition, the necessity of assuming this role precludes other activities which may be equally important to the EAP, such as follow-up, organizational integration and attention to corporate-wide problems, such as drug abuse and managed health care.

Corporate Isolation

The decision to keep EAP training separate from the corporate training function has generally evolved with the development of the EAP within the company. This has hindered the ability of EAPs to become fully integrated within the corporate culture and organization. The cost for maintaining a separate training activity, rather than coordinating it with the training department, should be examined carefully by each EAP. To the extent that any unit, function, or activity stands outside the general structures and activities of a system, it pays a price for the isolation in how it is perceived and valued by the members of the system. Since EAP training is isolated from the general management training of the corporation, it will be cast in a different light, and its training context altered to reflect the separateness

and isolation. While a case may be made that within a particular company this may be functional, for most settings such isolation is more likely to have negative overtones and unfortunate results.

CONCLUSION

Today's corporate environment requires very sophisticated operations to reflect the changing nature of the employee population as well as the vast array of new technologies. In addition, as new issues such as AIDS, wellness, and work-family enter the workplace, new information and management techniques need to be provided to the workforce. Training, whether conducted by the EAP or by another corporate department, is a crucial operation charged with facilitating such growth and change. It is clear from the present study that EAPs are committed to continuing to provide training within the corporation. However, EAP-training is increasingly competing in a crowded arena for space and attention, and its training efforts appear to be somewhat lagging behind other training initiatives.

It is probably in the best interests of the EAP to work towards integrating EAP training more into the corporate mainstream. Maintaining a separate training program is costly to the EAP especially in these times of diminishing resources. In addition, the sophistication required for effective training within the corporation is not easily obtained by EAP staff. The assumptions behind separating EAP training from other management training need to be re-examined, as do the benefits of integrating its training into the larger corporate training function. By moving from an isolated, or free-standing model, to an integrated model of delivering the training, the quality and effectiveness of EAP training may actually improve while advancing its own interests and goals.

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Commentary

COMMENTARY: NIDA's Role in Applied Research

Session Chairman: Charles R. Schuster, Ph.D.
Participants: Robert DuPont, M.D., Jerome Jaffe, M.D., and Herbert Kleber, M.D.

ROBERT DUPONT

We are sharing a remarkable piece of history today. The United States is in the midst of recommitting itself to dealing with the drug abuse epidemic. We will find, over the next few years, what we are made of as a nation. Are we tough enough to deal with the drug problem, and creative enough to use our antidrug efforts to make our workplaces, our neighborhoods, and our families better and stronger even than they were before we were hit by the plague of drug abuse?

Drugs in the workplace has become the critical battleground in the war against drug abuse. This Conference contains many of the leaders of that new effort. If we can get it right, here at this meeting, we can go a long way toward ending the drug epidemic. If we cannot, our country is in for a long, painful, and inconclusive war.

Let's start by looking back in time. This panel of the drug abuse establishment contains the first and the current directors of the National Institute on Drug Abuse (NIDA), the first Drug Czar in world history, and the current Deputy Drug Czar with responsibility for all of the non-law-enforcement side of national drug policy. Look at our ages: We are all in our fifties. Hard as it is to imagine, we were the "bright, young guys" in the drug abuse prevention field when it got started just 20 years ago. You might say that we have survived that tumultuous era to become the grey beards of today. We have other characteristics in common. We are all "doctors" -- three M.D.s and a Ph.D. -- and we are all devoted to the intellectual aspects of the drug problem. We are all what others call "researchers" and all professors at medical schools.

We are part of a cohort that was swept into the modern drug abuse field when it began in the late 1960s. From the beginning there has been an emphasis in this war, especially on the non-law enforcement side, on academics. There has also been a remarkable lack of partisanship: None of

us is a politician or is closely identified with any political orientation. Our mission through successive national administrations of both parties has been the same: to do the best job we could to solve the drug problem. In fact, it is not easy to see differences between our national response to drugs that relate to partisan politics.

When William Bennett, the latest Drug Czar, became the first non-expert in the drug abuse field and the first politician to hold that job, he turned to this same cohort to pick his Deputy for Demand Reduction. He asked Herb Kleber from Yale to help him.

That was not very different from the experience in 1971 when President Nixon first made drug abuse a top presidential issue and created the first Drug Czar. He turned to the University of Chicago and picked Jerry Jaffe to help him. When I became involved with drug abuse treatment in 1968, the man I turned to first was also Jerry Jaffe who, almost single-handedly, invented the multimodality drug abuse treatment program. Jerry also established a strong and remarkably resilient commitment to research both in treatment and in national antidrug policy.

The current NIDA Director, Bob Schuster, is the Ph.D. in our little group. He is one of the world's top research scientists in the field of drug effects, especially the effects of cocaine. All four of us have been in the drug abuse field for over 20 years, we have been friends who have shared in all of the drug issues in our national history during that time. Collectively, we have written several chapters of that history.

In looking over the recent past, it is clear that only twice has the drug abuse issue come to the top of the national agenda: first in 1971-1973, and the second time from 1986 to 1989. Let's go back together to 1971 and see what the drug abuse problem looked like then. What was known about drug abuse was largely learned at the Addiction Research Center (ARC), the "narcotics farm" as it was called in Lexington, Kentucky. It had been started by the Federal Government in the mid-1930s. Today the ARC has moved to Baltimore, Maryland. One of the central findings from the ARC experience was made by a young psychiatrist who worked there briefly, George Vaillant. He showed that not only did involuntary treatment work, but that it worked better than voluntary treatment for narcotics addicts.

We had our first modern war on drugs in 1971 because American servicemen in Vietnam were addicted to heroin. This frightening situation, combined with concern about crime in the streets, again caused by heroin use, led to the creation of the first White House Drug Office, the Special Action Office for Drug Abuse Prevention (SAODAP). In those days "drugs" meant "heroin". One of the more remarkable aspects of that era was that a strongly

conservative president made his mark in national drug policy by "balancing" the nation's traditional focus on law enforcement with a concern for treatment and prevention. This became known as the drug abuse policy of balancing Supply Reduction with Demand Reduction. In practice that meant balancing the voices of the "cops" with the voices of the "docs" at the national level. The antiheroin efforts from 1971 to 1973 were remarkably successful as Turkey, and later Mexico, the leading source countries, were persuaded to stop supplying heroin to American drug abusers. Even more dramatic was the unprecedented growth of drug treatment, especially using methadone, and the explosive growth of drug abuse research, building on the foundations of the ARC. Drug abuse treatment and drug abuse research became in the 1970s modest growth industries.

Then the drug issue waned. The White House Drug Office, SAODAP, was closed in 1975. Although not disappearing from the national political agenda, the drug problem receded in importance. The early lessons about heroin addiction and crime were well learned; too well learned as it turned out. In the mid-1970s policy makers, including those at this table, emphasized that the serious drug problem was heroin and other "hard" drugs. This widely held view led to the conclusion that marijuana and cocaine were relatively benign and not the appropriate subject of major national concern.

The ARC had helped us recognize physical dependence of the morphine (or heroin) type as the hallmark of drug dependence. Marijuana and cocaine did not produce this sort of physical dependence. This science set the stage for an entire generation of Americans who grew up learning that marijuana and cocaine were not "addicting." Policy followed and the stage was set for these two drugs to emerge as the Gateway Drugs in the late 1970s, the most commonly used illicit drugs in the United States. In 1988, for example, 12 million Americans used marijuana and 3 million used cocaine.

NIDA's own research in recent years has helped to explain the apparent paradox that "nonaddicting" drugs are now causing the most serious drug problems in the country. Addiction has comparatively little to do with physical dependence. It has everything to do with reward or liking. Drugs cause addiction because drug users not only like them but because they fall in love with getting high, and in the process lose control over their drug use and many other aspects of their everyday behavior. Cocaine in general, and smoked cocaine or crack in particular, are now known to be uniquely addicting even though cocaine does not produce physical withdrawal of the morphine type.

When the drug issue came back to prominence again in 1986, with the tragic and stunning death of Len Bias and the emergence of crack cocaine as the only drug epidemic that was then getting worse, it came back in an entirely

new way. The focus was no longer on heroin and crime, but on marijuana and cocaine. The focus of national concern about drug abuse was not the underprivileged or the unemployed, it was not the inner city or the minority community. Drug abuse in 1986 involved the mainstream of American society. The principle drugs that now cause alarm are the most widely used illicit drugs, marijuana and cocaine.

A recent analysis of the 1985 Household Survey showed that current users of illicit drugs were predominantly male (60%), that 69% were between the ages of 18 and 34, and that 70% were employed. Only 14% were black. Six percent were Hispanic and 80% were white. Equally remarkable, only 24% were from large metropolitan areas or nonmetropolitan areas. This picture could hardly have been more different from the "typical drug abuser" as seen in 1971, when criminal unemployed minority young men were the focus of national drug abuse concern.

What, you are surely asking by now, does this history lesson have to do with our conference on drugs in the workplace? Responding to today's concerns, if we are to curb the demand for illicit drugs, we are going to have to reach the typical users of illicit drugs and convince them to stop. The key to doing that is to invoke "job jeopardy," as the practice was developed over several decades in the alcohol field in the workplace: "If you come to work you come drug free. If you use drugs you lose your job."

That approach, as you have heard at this Conference, is central to the current national strategy to end the drug epidemic, as well as to efforts to contain the escalating costs of drugs in the workplace. These costs include lost productivity, reduced competitiveness, and increased problems of health and safety. Overall, I have estimated that American workers, whether or not they use drugs and alcohol, are today paying an Average Chemical Dependence Tax of $1,000 per year. The workplace drug abuse prevention programs we are discussing today are the best hope of cutting that tax.

Two final points before I surrender the microphone today. First, the most remarkable development of the last 20 years in our field of drug abuse prevention has nothing to do with government action. It is the emergence of mutual aid, the 12-step programs of Alcoholics Anonymous (A.A.), Narcotics Anonymous (N.A.), Al-Anon, and Children of Alcoholics (COA) and others, as the modern miracle of recovery, as a revolution in our midst. These programs offer real hope of long-term recovery for individuals, for families, and for communities.

Second, even as we learn the importance of focusing major antidrug efforts on marijuana and cocaine, as we retarget on the employed or "casual" drug user, we need to also remember the problems of drug abuse in the early

years of the current epidemic. The "underclass" today are suffering from drug abuse to a disproportionate extent. They are not fully participating in the remarkable downturn in drug use in the United States during the last decade. They suffer not only individually but collectively, especially because of the family disorganization and violence caused by their drug use, especially their use of crack cocaine, and from the spread of AIDS through needle sharing. We also need to reemphasize the role of the criminal justice system to identify and to help end drug problems in this relatively small but terribly vulnerable segment of our population. Even as we gear up to deal with the drug problem in mainstream America we need to avoid the mistakes of the 1970s by taking a one-track approach to our drug problems. Drug abuse in America now has two faces: one in the middle class and the other in the lower class. We need to have a drug policy that does not favor one or the other but which pursues both with true commitment.

If we can learn that lesson, and apply it with determination over time, we have the first real hope that the drug problem can be overcome in this country. The outcome of this Conference will go a long way to answering the question of whether, as a nation, we are tough enough to achieve that goal.

In conclusion, let me salute the real heroes of our Conference, our leaders Mike Walsh and Steve Gust. As the first Director of NIDA, I may be forgiven some pride in the accomplishments of this distinguished organization. None, in my estimation, has had a greater impact on the national capacity to understand and overcome the drug problem, than have the efforts of the workplace programs of the Division of Applied Research. The beginning efforts on modern drug testing were based on the science pioneered at NIDA. It was developed in the Department of Defense, with NIDA's technical assistance, over the last decade. NIDA has in the last few years taken that experience from the DoD and brought it to civilian employment. That has been an historic achievement for which NIDA can be greatly proud.

The task of this "Drugs in the Workplace" Conference is to bring together the leaders in this still-building field, to organize our current state of experience and knowledge, and to point the way to the future for research and practice. The goal is to help our country work drug free. That is a critical subgoal of our overall objective of ending the drug problem in our country. Today's Conference is a giant step toward that goal.

In 20 years I hope some of you will be at a meeting like this one talking about what we have learned over those years. If you come to such a meeting, I predict that you will look back on this Conference as an important turning point in that effort.

Thank you.

JEROME JAFFE

I'm glad to be here with these distinguished colleagues who, as Bob Dupont has indicated, have had, collectively, more experience than we care to admit.

For a brief period of time, NIDA was sleeping, not recognizing the importance of self-help groups, parents groups and drugs in the workplace, but Bob Dupont was not. On his own, after he left NIDA, he has been deeply involved in all of those issues. The bureaucracy is not always able to respond to new developments or sometimes it just does not see them as clearly as the private sector does.

I would like to address a few remarks to the concept of technology. At various points in the history of the country's social problems you have to look at what resources or technology you have or should have to deal with these problems. Then perhaps you need to invent new technology, or use what you do have in different ways. New technology changes lives. There is no question about it. New technology certainly changed the way we dealt with the epidemics of drug abuse in the military in 1971. Just as TV and computers, have changed lives, the availability of low cost reliable urine testing, a new technology, is changing lives. We have to recognize that it's there.

There is always a question as to whether we can control the impact of a new technology. It is clear that positive tests for drugs on urine samples are correlated with poor performance, more accidents, more sick leave, and a higher likelihood of dismissal whether you look at the military or the private sector. That has been reasonably well established. Further, random urine testing imposed upon a workforce results in a subsequent decreased percentage of positive urine tests in that workforce, and an associated decrease in accidents. I suppose such testing may even result in decreased numbers of defects in some kinds of manufacturing situations. Random urine testing probably brings users to the attention of EAP programs. These seem to be reasonably reliable results. What are the problems associated with such testing? Pre-employment testing can screen out the illicit users who are generally less satisfactory employees, but what happens when we can't attract enough employees because the pool of competent people is shrinking? Right now the President, who wants to be called the Education President, is meeting with 50 governors talking about, not the drug crisis, although that was in fact his first major address, but the fact that we are not training

enough people at a high enough level to fill the positions in industry. We are just not training enough people at a high enough level. Yes, we can begin to screen out people with pre-employment testing, and we can discharge those that are positive when tested after employment. It looks cost effective when you limit your unit of analysis to that particular industry. But what happens if many industries begin to use the technology for the same purpose. You do not take these people into the workforce; you have a shrinking pool of people that you can recruit; the only way you can handle that is to raise salaries. Over the long term, this is going to change your cost benefit analysis. So that the time frame of the analysis is always an issue that one has to look at.

But whether the cost benefit analysis comes out well or not, industry may not have any choice as to whether to use this technology, because technology brings with it its own imperatives, and its own standards for corporate performance. Just as the advent of x-rays made taking an x-ray in certain situations the minimally acceptable level of care, and just as that technology has been superceded by the CAT-scan, corporations whose employees can effect the safety of the public may be expected to take steps to detect and eliminate drug and alcohol use by their employees whether they find it cost effective or not. So the lawyers who sue people who don't live up to a standard level of performance may eventually dictate how the technology is used. There are many doctors out there who don't think we ought to be using a CAT-scan every time somebody bumps his or her head. But then if there are enough juries who say maybe you should have used a CAT-scan it turns out to be cost effective, at least in the short term to do a CAT-scan after a head bump. Such a process is what the private sector is going to have to deal with. It is going to be very different for different industries, of course. But my point here is that there is a new technology; it's been shown to effect the number of positive drug users. Now mischief is afoot. Of course, it is not always mischief, but, in fact, we may not be able to decide for ourselves just how much urine testing we are going to have to do. But, for now, it looks like testing is going to be a permanent part of the corporate American scene, at least I would suspect that this will turn out to be the case.

NIDA will have a critical role in helping to shape the use of this technology, primarily by fostering interchanges such as this one, and by continuing to support the evolution of the technology itself, helping to make it less expensive, less intrusive, and less subject to error. I don't think that we should anticipate that five years from now we will still be talking about urine testing with all that it implies about intrusiveness. I have a feeling that other techniques equally reliable, perhaps equally low in cost, may evolve.

I believe that EAP is an area which has major potential for reducing the demand for drugs and in that I am in absolute agreement with Dr. Dupont. Such programs are deserving of more investment and research on their efficacy. I think that it is unfortunate that our universities, (at least most of those that I am familiar with) feel that if research does not look like it may yield the Nobel prize, it does not seem to be worthwhile. It is always difficult to attract the best minds to look at service type research, and it is going to be a challenge for NIDA to run against that current, to see that such research is an important part of the National strategy.

I have some misgivings about emphasizing research on drug induced cognitive psychomotor impairment which we heard about yesterday. I don't think that this is the best use of resources. I don't think we need to demonstrate ad nauseam that drugs can impair some types of cognitive and psychomotor performance. I don't even think that any amount of research in that area will lead to useful policies in the real world. Now this may seem to be heresy on the part of somebody working for an agency that funds this research, but consider the following: the difference between individuals is probably far greater than the difference between the very competent people slightly impaired and the least competent people not impaired at all. Michael Jordan, legally intoxicated, could outplay any two people at the National Institute on Drug Abuse on the basketball court when they are stone sober. To show that a half of an antihistamine will reduce somebody's performance on a digit-symbol substitution test does not impress me at all as leading to any sensible kind of policy. Stop every tenth car on Wisconsin Avenue, and you may find somebody who is driving whose vision is impaired. You have great difficulty therefore, in justifying your urine testing on the idea that drugs impair performance. You do not have any difficulty saying that society has the right to decide what is acceptable behavior, and we have decided in this country that using illicit drugs is not. That is all you really need. I do not think that we should be justifying a testing program on the issue that sometimes if you use a drug a day later you might have an impaired score on the digit-symbol substitution test. I believe that if we emphasize this aspect too much, it will lead us into areas that we just won't be able to deal with. There are a wide range of therapeutic drugs that are not illicit but also affect performance. If your real concern is the effect of drugs on performance what do you expect to do in the workforce about antidepressant drugs, about anti-epileptic drugs, about drugs used for hypertension, drugs used for heart disease, drugs used for allergy, and cancer? Although most of these are not necessarily directed at the central nervous system, they get into the CNS and they do impair performance. So you have to be careful walking down that path as a justification.

We should not be required to show there's impairment to justify a national concern. I would suggest that the focus should shift more and more to questions on how EAP programs can best alter the behaviors of those found to be using drugs on the basis of urine testing. However, to say that such drug use is altered by EAP's is not enough. We need to know the relative contributions of the counseling and of the urine test itself with its impact and the implied contingency contracts that are associated with it. We need to know whether cessation of use by an individual is of long duration, and is associated with increased productivity. And we need to know more and more about the costs and benefits of the intervention system. Here I want to come back to the point I made in the beginning. It is critical that you think carefully about the size of the unit for that kind of cost benefit analysis. Let me give you an example. You heard about a particular power company that found that if they detected drug use and they fired everybody that was positive, it was cost effective. From the perspective of that company it was cost effective, but if you did the analysis on the basis of how many of those people that were fired picked up unemployment insurance, how long it took them to get back to work, and who had to retrain them for other jobs that they had been trained for, you might have found a very different kind of cost benefit analysis. In point of fact, even had the cost benefit analysis shown that you only got back 90 cents on the dollar invested trying to rehabilitate those people, if you had taken a broader view of the problem you might have found that it was better to do that than to simply fire them. Now, if that turns out to be the case when such broad based analyses are finally carried out, we are going to have to find ways at the National level to motivate the corporations to invest a dollar when the corporations only get back 90 cents. Because, if they take the narrow view, which is - let's export our problem to the community or to some other corporation, ultimately this is going to be a vicious circle, in which impaired people are not going to get jobs at all or they are going to get jobs in other companies only to get fired again. This does not do anybody any good. This is a problem that Dr. Kleber I'm sure will address as he thinks of ways to motivate corporate America to invest in this very important approach to reducing demand.

These are the kinds of studies that I hope NIDA will get into. I think I made the point that this is an essential area for reducing demand, but we need to be very sophisticated about how we analyze our impact and most of all we need to realize that we are just beginning in the last few years to build this system of demand reduction. It may take us at least another decade to understand how best to use this technology. If we are going to do that we need to be investing more and more in research, on its efficacy, and the techniques that we can use to improve it.

HERBERT KLEBER

I should like to begin by echoing some of the points that have already been made. I applied for my first grant in the late sixties to treat drug addicts. The person I went to for a critique of my first grant before I submitted it was Jerry Jaffe who I consider the "mavin". I remember in the mid seventies being on the first advisory council to NIDA when Dr. DuPont was its director. I certainly have benefited substantially from the work that Dr. Bob Schuster has done. So I'm the new guy on the block. I don't know about this age thing that Bob DuPont was talking about - all of us being in the same bracket. I see these three guys in the same bracket and I am the youngster.

Bob DuPont's point was very well taken - that involuntary treatment can work. There is increasing evidence, for example, the civil commitment study from California that Doug Anglin has described, which indicates that, if carried out properly, it can work very well.

The new Strategy proposed by the President and the Office of National Drug Control Policy stresses the importance of the casual drug user as an important vector for the problem of drug use and abuse. That is, once you become an addict you are not a very attractive individual. No one wants to be like the addict - the more burned out he is, the less likely he is to be a good role model. The casual user, on the other hand, gives the message you can have it all. You can use drugs, enjoy their pleasurable effects and still keep your job, your health, your family, and your material possessions. By the time such persons get into trouble with drugs, they often have lost their jobs and people don't see them. The new role model is the new casual user. In many ways, therefore, the casual user is the vector, the spreader of the disease, much more so than the addict. It is rare that individuals purchase their drugs initially. They are usually given to them by someone they know, a so called friend, an older sibling, someone at the workplace. That is one of the key reasons why the Strategy says if we are really going to get a handle on this problem, we have to look at such individuals and, as has been pointed out, once they are out of school, they are most likely to be in the workplace. Most poor people don't use drugs and most of the people that use drugs are not poor. They are working and you find them in the workplace. So if we are going to do something about the demand side of drug abuse, the workplace is one of the most crucial parts of that crucial part of the Strategy.

We feel it is very important in the private sector that employers establish tough and yet fair drug policies that communicate expectations of behavior but also are fair as far as employees' rights and responsibilities, and describe what actions will be taken in response to an employee found using illegal drugs. A drug-free workplace means a number of things. It means that casual use is reduced or eliminated altogether and it means getting treatment for those who need it. How are casual users and non-users dissuaded? - by unambiguously communicated policies and expectations. Surveys tell us that casual users - not altogether but to a great extent - are dissuaded by fear of being caught if there are very clear consequences once they are caught. The likelihood of being caught can be increased in a number of ways - by urine testing as we have heard, but also by well trained supervisors, and by the kind of workplace in which peers are comfortable reporting the use of their fellow workers. I want to return to that as one of the lesser utilized models in the workplace and one I believe should be given more emphasis. There is also an important responsibility to get those who are in trouble with drugs into treatment. Employers have incentive and reasons: it's the humane thing to do: if addiction can be prevented it is beneficial for the individual as well as for the company; economic and social costs are reduced; and, finally it provides hope for others. Given the contagiousness of drug use, the larger the number of people who use, the greater the pressure on non-users.

What do I see are the questions that we need to research? Let's start with EAPs. How effective are they? How often do they actually refer someone to treatment for drugs? How many EAP's do routine screening tests for drugs? Once they identify individuals as having drug or alcohol problems, do they get them into the appropriate treatment modality? Prior to my present position, I served on an IOM (Institute of Medicine) task force looking at how substance abuse treatments should be funded. I remember our very first meeting when we heard from one of the largest EAP referral firms in the country and the woman described how she decided what program to refer people to. The first item was they had to be a 12-step program and then went on to list other items. During the question period I asked "...on what empirical basis do you decide that these programs are the ones you should refer to? Do you have any follow-up data that the people you refer to these programs do well? How are they doing six months later? Do you have any idea how well a program works in terms of the number of people who remain?" She said "...well, I visit the program and I can tell by the feeling in the pit of my stomach whether these are good programs". I thought "...if this is one of the largest firms in the country and decisions are being made by what this woman feels in the pit of her stomach, the field is in trouble...". We can't continue to rely on that.

There need to be much better outcome studies. EAPs need to have data on who they are referring, what happens to them, what kind of programs have what outcome? Should EAPs be accredited? In the vocational field there is an organization called CARF which accredits vocational programs. In the hospital field we have JCAH (Joint Commission on Accreditation of Hospitals). We ought to have some similar, not for profit, national agency that evaluates EAPs. That way employers would have a better idea of what they are paying for and whether they are getting what they need. It is not clear how best they should be evaluated. I am not an expert on EAPs but I am sure there are reasonably good ways of doing that. That idea was given to me a couple of weeks ago by Dale Masi who I believe is one of the experts in this field. I think it is something the field should go ahead with.

Are supervisors effective in detecting problems or is it more often the fellow workers? In talking to people working in factories, it seems the people who know best who are using drugs are the co-workers. They are probably much more likely to know than the supervisors. What kind of milieu do you set up that makes it more likely that a peer will refer someone to an EAP, or to the supervisor? It seems to me intuitively, that peers are more likely to refer if they believe that the person will get help rather than get fired. And so employer policies that say in essence "...you will be fired the first time you are caught..." will probably mean that you get minimal to no peer referrals. That is what used to happen in the railroad industry before they instituted the Rule G bypass.

The numbers from the military random drug testing programs are encouraging as to what can be accomplished in industry. One of the studies, however, that I would like to see done on a cooperative basis, perhaps something between NIDA, the Defense Department, and the VA, is what happens to those individuals who are discharged from the military because of failing the drug testing. I think that might answer some of the questions that Dr. Jaffe raised about the civilian workforce. It should be a much easier group to follow. It is a relatively small group (compared to other populations) of individuals; we have a fair amount of data on them; about what their life was like before they went into the military, and we should be able to find out, what's happened. I believe it is an important area of data that we need to find out.

Do we really know how good drug testing that is not random is in terms of yielding effective results? There are four types of testing: pre-employment, incident driven, on suspicion, and random. Random is the primary one that is a lightning rod. In general, both employers and employees can accept the first three kinds of testing, with some exceptions. It would be nice to have some studies done. What do you pick up by those first three? How much do you lose by not having random? As a scientist, I would like to see

decisions driven by data to the extent possible. What is the cost feasibility of drug testing for average size businesses, and for the small business? We believe that illicit drug use per se is wrong, and that a positive urine is grounds for referring to treatment or counseling if the worker has a drug problem or posing sanctions saying you can lose your job. But for the small business of fifty to 100 employees, is this cost effective to them? How do the really small businesses in America, the 10 to 50 employee group provide for drug free workplaces? Is urine testing the way to go? Or will peer referral and supervisor training to pick up drug use be more efficient and cost effective?

Finally, the Federal Government has started to set an example of a drug-free workplace for its own employees. But more needs to be done nationally. We should be citing model programs as the Department of Labor has begun to do. What can be done to improve state laws? One of the complaints I get from large industries that operate in various states is that some of the laws about urine testing in different states make it very hard to have uniform policies. A state like Vermont which I understand has very restrictive laws makes it hard for an interstate company to apply the same policy there that they apply in a different state. We are working on developing model state laws that could be used for all states. They may not adopt them but at least that is an initiative that our office can take.

How can changes in insurance coverage help bring about a drug-free workplace and insure appropriate treatment? The upcoming IOM study may give us some answers on that. It is a crucial item. If an individual is found out to be impaired and needs to be referred for treatment, it is important there be some way for that person to get treatment either via insurance or categorical programs provided via the block grant. We know there are problems with mandated insurance, such as more major employers dropping out or self-insuring than when not covered by mandates. It is a tricky issue.

After treatment, how often is there successful reintegration into the workplace? Again, we do not have enough data. The Exxon Valdez episode is causing major reverberations across the workplace scene, as employers ponder the question should they be taking people back into jobs of responsibility who have had significant substance abuse problems. If the field wants business to do it, professionals need to provide the appropriate data on outcome success. Finally, what can be done to improve the likelihood and success of reintegration into the workplace both for those individuals who had to be let go because they have failed more times than that company is prepared to accept or those who are not in the workplace because they keep failing that pre-screening? Are we going to come up with a large group of unemployables? Let me stop with those series of questions.

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